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HANDBOOK OF THE  
2.95-INCH  
MOUNTAIN GUN MATÉRIEL  
AND  
PACK OUTFIT

(Twenty-five Plates)

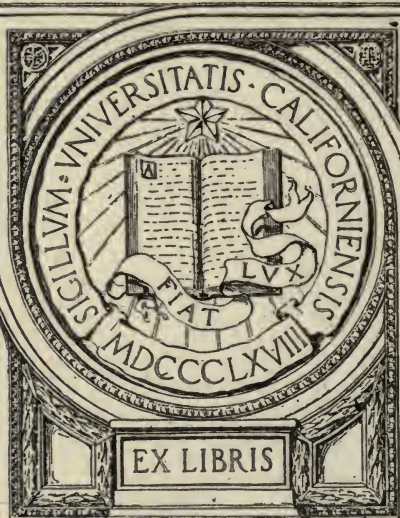
JUNE 10, 1912  
REVISED SEPTEMBER 15, 1916



WASHINGTON  
GOVERNMENT PRINTING OFFICE

1916

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AUGUST 1916

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WAR DEPARTMENT,  
OFFICE OF THE CHIEF OF ORDNANCE,  
*Washington, September 15, 1916.*

This Manual is published for the information and government of the Regular Army and National Guard of the United States.

By order of the Secretary of War:

WILLIAM CROZIER,  
*Brigadier General, Chief of Ordnance.*

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## HANDBOOK OF THE 2.95-INCH MOUNTAIN GUN MATÉRIEL AND PACK OUTFIT.

*List of equipment furnished by the Ordnance Department pertaining to one mountain battery equipped with 2.95 inch mountain gun matériel.*

No.	Equipment.	Class.	Section.
4	2.95-inch mountain gun.....	IV	2
4	2.95-inch mountain-gun carriage equipped with open and panoramic sights.....		
84	Ammunition chests.....		
24	Pack covers for kits.....		
8	Pioneer rolls.....		
4	Supply chests.....		
1	Schaller forge and tool chest.....		
79	Pack harness.....		

For description, this equipment is divided into the following parts:

Part I. The equipment issued with each gun and carriage—

- (a) The gun, ammunition, and accompanying parts.
- (b) The carriage and sights.
- (c) Tools and accessories for the gun and carriage.

Part II. The packs for one battery—

- (a) The pack harness.
- (b) The special pack equipment.
- (c) The tools and accessories for special pack equipment.

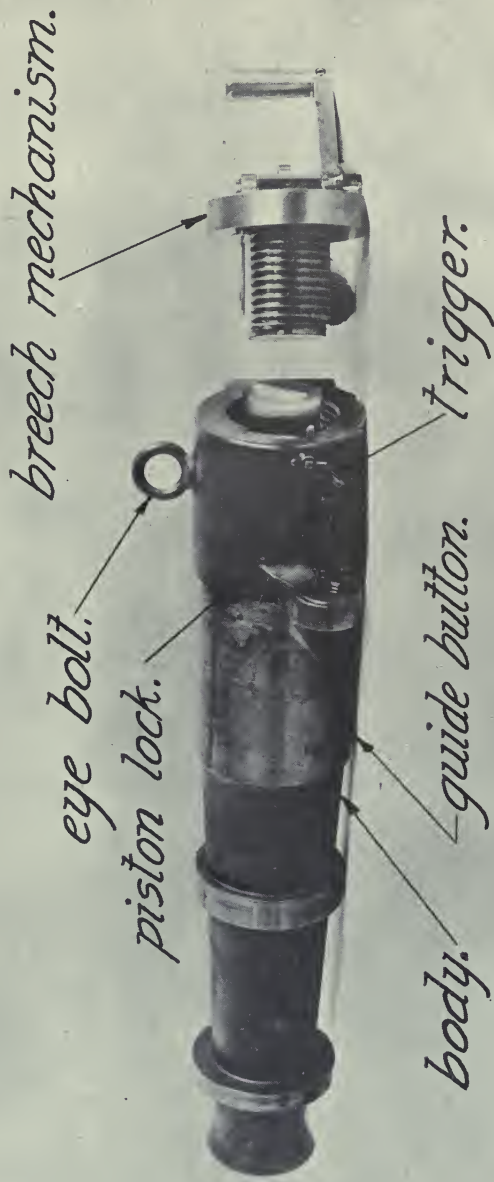
Part III. Allowance of ammunition and targets.

Part IV. General information.

A description of each of these parts, together with a statement of the total equipment issued to one mountain battery, follows:







2.95In. Mountain Gun.



# Part I (a). THE GUN, AMMUNITION, AND ACCOMPANYING PARTS.

*The gun, weights, dimensions, etc.*

Weight of gun, including breech mechanism.....	pounds..	236
Caliber.....	inches..	2.953
Total length.....	do....	35.85
Length of bore, including chamber.....	do....	31.6
Length of rifled portion of bore.....	do....	24.33
Rifling, uniform, 1 turn in 25 calibers, right-hand twist:		
Number of grooves.....		30
Width of grooves.....	inch..	.23
Depth of grooves.....	do....	.023
Capacity of powder chamber.....	cubic inches..	34.9
Weight of projectiles.....	pounds..	{ 12.5 18
Weight of powder charge (N. C. smokeless):		
For 12½-pound projectile.....	ounces..	8
For 18-pound projectile.....	do....	7
Weight of cartridge case.....	pounds..	1.45
Muzzle velocity:		
12½-pound projectile.....	feet per second..	920
18-pound projectile.....	do....	750
Maximum chamber pressure.....	pounds per square inch..	18,000

## *Nomenclature of parts of gun.*

Part.	Description or location.	Class.	Section.
Body.....	With lugs for carrier and piston rods integral.....	IV	2
Guide button.....	Screwed into barrel underneath.....		
Eyebolt.....	On rear of barrel, interchangeable with eyebolt on cradle.....		
Breechblock.....	In breech of gun.....		
Pallet, hardened steel.....	Attached to breechblock with 2 screws.....		
Fixing screw.....	Secures cocking cam in breechblock.....		
Carrier.....	Pivoted to breech of gun body.....		
Carrier axis pin.....	With split pin fixes carrier to gun.....		
Cocking cam.....	In breechblock.....		
Extractor.....	Pivoted to breech near carrier hinge.....		
Extractor axis pin.....	With split pin fixes extractor to gun.....		
Firing pin.....	In center of breechblock.....		
Firing-pin point.....	Screwed into firing pin.....		
Guide plate.....	On rear of breechblock.....		
Hand lever.....	Pivoted to carrier.....		
Hand-lever axis pin.....	With split pin fixes lever to carrier.....		
Hand-lever catch.....	Locks hand lever in closed position to carrier.....		
Hand-lever catch spring.....	Actuates hand-lever catch.....		
Hand-lever catch pivot.....	Special split pin.....		
Locking bolt.....	In a recess in the carrier.....		
Locking-bolt rivet.....	Secures the locking-bolt spring to bolt.....		
Locking-bolt spring.....	Actuates the locking bolt.....		
Mainspring.....	Coiled spring in firing pin.....		
Trigger sear.....	Pivoted in carrier.....		
Trigger sear spring.....	Returns the trigger sear to engagement.....		
Trigger, complete, consisting of--			
Trigger.....	Assembled in breech of barrel, left side.....		
Trigger lever.....	With split pin, has an eye for lanyard.....		
Trigger spring.....	Coiled spring on trigger.....		

*Serial list of component parts of breech mechanism.*

[Numbers before components refer to numbers shown on Plates II and III.]

	Class.	Section.
1. Breechblock.....		
2. Carrier.....		
3. Hand lever.....		
4. Firing pin (with removable point).....		
5. Mainspring.....		
6. Guide plate.....		
7. Extractor.....		
8. Locking bolt (with spring).....		
9. Sear (with spring).....		
9a. Sear stud.....		
9b. Sear bent.....		
9c. Sear safety arm.....		
9d. Sear actuating arm.....		
9e. Sear spring.....		
10. Trigger and spring with trigger lever and split pin.....		
11. Gear segment of breechblock.....		
12. Hand-lever bevel pinion.....		
13. Cocking piece, showing cams.....	IV	2
14. Studs on firing pin.....		
15. Safety groove in breechblock.....		
16. Groove in breechblock in which projection on trigger-sear safety arm travels during unlocking.....		
17. Protection on trigger-sear safety arm.....		
18. Carrier axis pin (with split pin).....		
19. Hand-lever catch (lower portion).....		
20. Hand-lever axis-pin lugs.....		
21. Hand-lever axis pin (with split pin).....		
22. Hand-lever stop.....		
23. Hand-lever catch (with split pin).....		
24. Hand-lever catch spring.....		
25. Firing-pin recocking hook.....		
26. Firing-pin bent.....		
27. Extractor axis pin (with split pin).....		
28. Short arm of extractor.....		
29. Spring catches for piston rod (with screw, washer, and spring).....		

## DESCRIPTION OF THE GUN.

The 2.95-inch mountain gun is designed for pack transportation and consequent rapid assemblage to, and dismounting from, its carriage. The term "gun" is used to include the body of the piece and breech mechanism. The body is one piece of steel having in addition to the usual lugs provided for the hinge of a swinging breechblock two others, at right and left of the breech, for attachment to the piston rods of the carriage. The exterior of the body for a distance of 8.5 inches forward of these lugs is cylindrical and, supplemented by two collars of the same diameter formed farther forward, constitutes the bearing of the gun in the cradle. The guide button on the bottom of the barrel slides in a groove in the cradle and resists the twist due to the rifling. The vertical and horizontal planes passing through the axis of the bore are indicated on the muzzle by the grooves cut in the metal. Fine threads or wires may be stretched across in these grooves to make a front bore sight for use in verifying sights, etc. An eyebolt is threaded into the body at the breech for lifting the gun.

The breech mechanism consists of the breechblock and cocking cam, carrier, hand lever, firing pin, mainspring, guide plate, extractor, locking bolt, trigger sear, and trigger.







*Breechblock.*—The breechblock locks into the body with an interrupted screw. The center of the block is chambered in front for the firing pin and in rear for the cocking cam, the latter being separate from the block for manufacturing reasons only and solidly secured to it by two lugs and the fixing screw. In the rear face of the breechblock are cut two concentric grooves and with the partition between them cut away in two places to allow the projection on the end of the safety arm of the sear which engages these grooves to pass from one to the other. On the rear face of the breechblock is a circular toothed segment which is engaged by the segmental bevel pinion of the hand lever. There is also a recess on the rear face of the block lined with a hardened steel pallet into which the locking bolt enters when the block is revolved sufficiently to disengage the interrupted threads; the locking bolt then preventing further rotation of the block while moving with the carrier in and out of the breech.

*Carrier.*—The carrier which holds the breechblock is pivoted to the right side of the breech by the carrier axis pin. It is bored partly through and threaded to engage the continuous threads at the rear end of the breechblock. A reduced bore passes through the carrier and receives a boss on the guide plate. A recess on the inner or front face receives the locking bolt and its spring, which is secured to the locking bolt by a rivet; a recess in the lower hand-lever axis-pin lug on the carrier engages the hand-lever catch, thereby securing the hand lever when the breech is closed. On the rear face of the carrier are two lugs. The hand-lever axis pin passes through holes in these and through a hole in the guide plate which it secures in place. Between the two lugs is a slot which embraces the stud on the rear face of the trigger sear.

*Hand lever.*—The hand lever is pivoted to the carrier by the hand-lever axis pin. The handle or grip is recessed to receive the hand-lever catch, which is pivoted in the hand lever by a large split pin (hand-lever catch pivot), a leaf spring (hand-lever catch spring) being seated in the catch to insure its engagement when the breech is closed. The segmental bevel pinion of the hand lever is concentric with the axis pin and engages the toothed segment of the breechblock. When the hand lever has been pulled around on its axis until the breechblock is properly disengaged, a projection on the hand lever adjoining the pinion contacts with the rear face of the block and prevents further rotation of the hand lever. The hand levers that were manufactured at Watervliet Arsenal are not interchangeable with those of guns purchased from Vicker's Sons & Maxim.

*Firing pin.*—The firing pin is a hollow sleeve provided with two lugs which ride upon the cam surfaces of the cocking cam. A hook, which extends to the rear through recesses in the carrier and the guide plate, prevents the firing pin from turning when the breechblock is

rotated and makes recocking possible without opening the breech. Near the rear end of the body of the firing pin the metal is cut away, forming a bend or notch into which an arm of the trigger sear drops. The firing-pin point is screwed into the firing pin and is replaceable.

*Mainspring.*—The mainspring is a helical spring which fits inside the hollow in the center of the firing pin and into a recess in the guide plate. The guide plate retains it in place.

*Guide plate.*—The hand-lever axis pin passes through a hole in the guide plate, thus retaining it in position. The guide plate is recessed to receive the mainspring, and recesses on the sides allow the recocking hook of the firing pin and the sear stud to pass through.

*Extractor.*—The extractor is pivoted near the carrier hinge on the extractor-axis pin. At the end of the extracting arms are claws which engage with the rim of the cartridge. It is actuated by the carrier striking against its short arm just before the breech is fully open.

*Locking bolt.*—The locking bolt fits in a recess in the front face of the carrier. When the breechblock is fully rotated ready to swing out, a recess formed in it comes opposite the bolt, which latter, acted on by its spring, moves forward and locks the block to the carrier. The locking-bolt spring is secured to the locking bolt by a rivet.

*Trigger sear.*—The trigger sear is pivoted to the carrier by means of a stud which fits in a groove in the center of the carrier and is secured there by the guide plate. Safety during loading is provided by means of the arm, which has a projection at its outer extremity which engages in the groove during the period when the breechblock is being locked. While this projection is in this outer groove the firing pin is engaged by the sear, so that the firing pin can not move forward and strike the primer. The sear has also another arm the outer end of which lies above the trigger lever when the breechblock is home. The arm has the sear spring attached to it, which causes the sear to engage the firing pin in the cocked position.

*Trigger.*—A square shaft on the trigger passes through a square hole in the trigger lever and is held in place by a split pin. The trigger is fitted in the breech of the gun; the trigger lever terminates in a loop to which a lanyard can be attached. When this is pulled the trigger revolves, causing the trigger to lift up the arm of the sear and so release the firing pin from the sear. The trigger is kept in its normal position by the small spring called the "trigger spring."

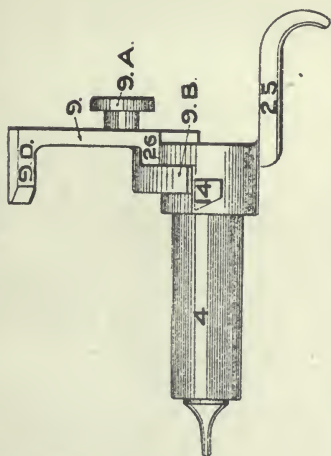
#### ACTION OF MECHANISM.

On grasping the handle of the hand lever the hand-lever catch is pressed in and its lower extremity thereby moved clear of the recess in the lower hand-lever axis-pin lug so that the hand lever is unlocked. On moving the handle to the right the bevel pinion thereon causes the



FIRING PIN AND SAFETY SEAR IN COCKED POSITION

FIG. 1



REAR VIEW OF BREECH BLOCK SHOWING SAFETY SEAR

FIG. 2

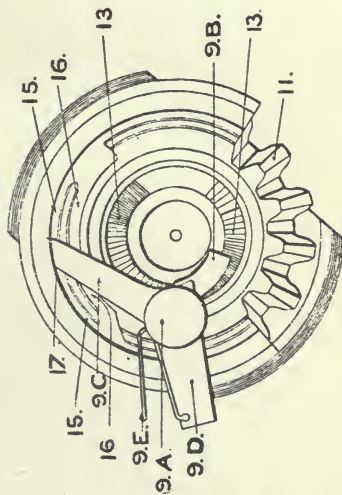
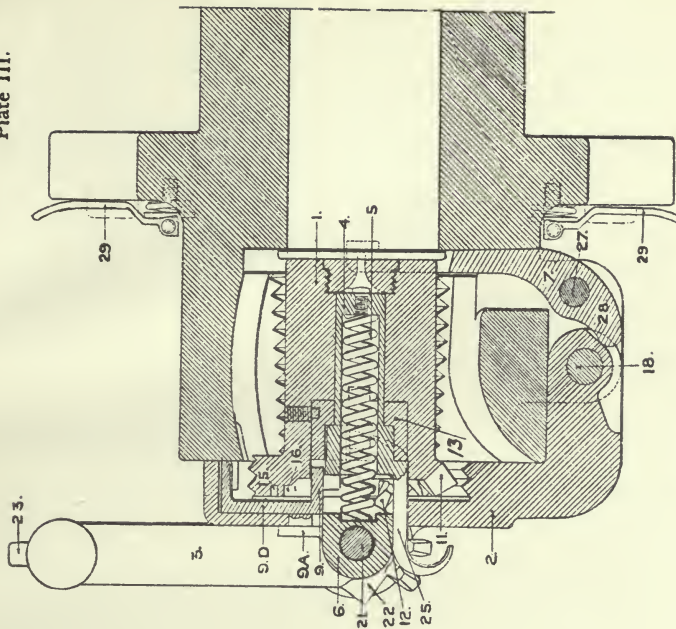


Plate III.



Sectional Plan Mechanism (closed).



breechblock to rotate. The rotation of the breechblock when being unlocked causes the lugs on the firing pin (which can not rotate) to ride on the surface cams of the cocking cam, thus compressing the mainspring; when the firing pin reaches the cocked position, the sear is forced by the action of the sear spring to engage with the firing pin, and at the same time the lug on the safety arm, which has traveled along the inner groove, is forced outward to the entrance of the groove; the threads on the breechblock are now clear of those in the breech of the gun and at this instant the hand-lever stop bears against the face of the breechblock and the locking bolt moves forward, locking the breechblock to the carrier so that the continued motion of the hand lever causes both to swing away from the breech together. When the block is clear of the breech the carrier strikes the short arm of the extractor, causing the latter to eject the empty cartridge case to the rear.

A new cartridge is inserted by hand, and, on moving the hand lever to the left, the breechblock (which is still locked to the carrier) enters the breech and forces the cartridge home. As soon as the carrier comes against the face of the breech the locking bolt is pressed in, releasing the breechblock from the carrier, so that the continued motion of the hand lever causes the block to revolve by means of the pinion, thus locking it securely in the breech. As soon as the hand lever is quite home the lower end of the hand-lever catch, actuated by the hand-lever catch spring, engages in the recess in the lower hand-lever axis-pin lug. The outer end of the arm of the trigger sear is now above the trigger, so that on pulling the lanyard (which is attached to the trigger lever) sharply to the rear, the arm of the trigger sear is lifted up and the firing pin is released from the sear, so that moving forward by the action of the mainspring it strikes against the primer and explodes the charge.

In the event of a misfire the mechanism can be recocked by placing the loop of the lanyard over the recocking hook of the firing pin and pulling sharply to the rear until the sear engages the firing pin and retains it.

#### DISMOUNTING AND MOUNTING THE BREECH MECHANISM.

*Dismounting.*—Remove split pins from the axis pins for hand lever, carrier, and extractor.

Close the breech and release the mainspring.

Press in guide plate and take out hand-lever axis pin.

Remove guide plate, mainspring, and firing pin.

Replace hand-lever axis pin and open breech.

Take out hand-lever axis pin and remove hand lever.

Press in locking bolt and unscrew breechblock from carrier.

Remove sear, locking bolt, and spring.

Take out carrier axis pin and remove carrier.

Take out extractor axis pin and remove extractor.

*Mounting.*—The assembling of the mechanism is performed in the reverse order to that of dismounting.

In inserting the block into the carrier the former should be held squarely against the face in such a position that the slot for the locking bolt is just under the slot in the carrier for the sear before commencing to screw it in.

#### AMMUNITION.

(Plate IV.)

Fixed ammunition is used in the 2.95-inch mountain guns, and is made up with the following types of projectiles:

Common steel shell,  $12\frac{1}{2}$  pounds.

Common shrapnel,  $12\frac{1}{2}$  pounds.

Cast-iron shell,  $12\frac{1}{2}$  pounds.

Cast-iron shell, 18 pounds.

No more 18-pound projectiles or cast-iron shell will be manufactured. Shell of future manufacture will be of steel.

The rounds as made up vary in length with the type of projectile used. The number of each kind to be carried is a matter for regulation by proper authority. Each round is issued with projectile filled and fuze. The weights of the projectiles are  $12\frac{1}{2}$  and 18 pounds. The components of one round are the cartridge case with primer, the powder charge, projectile, and fuze.

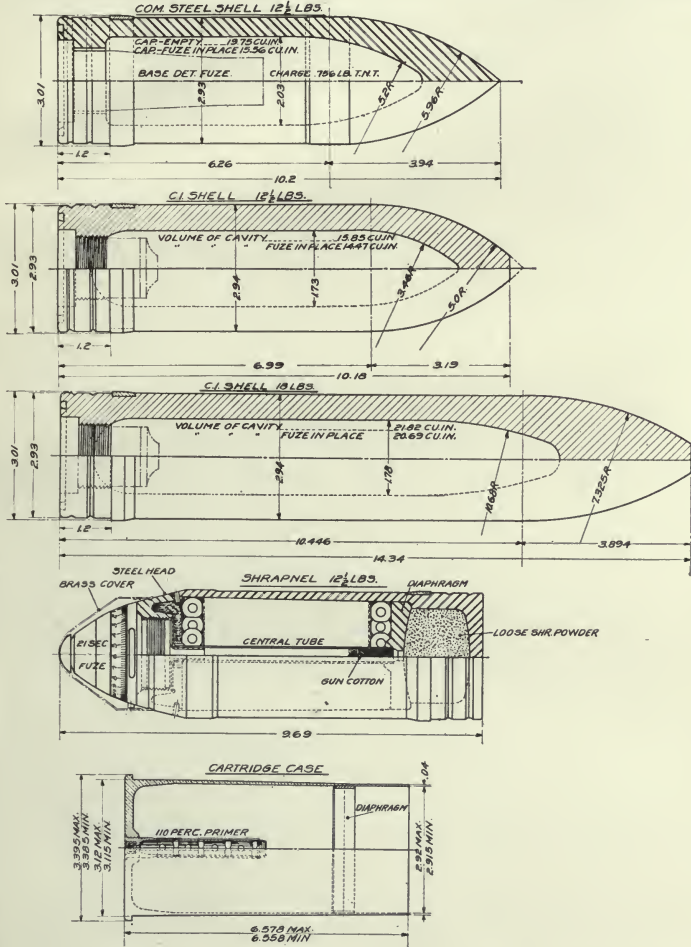
#### THE CARTRIDGE CASE.

The cartridge case (Pl. IV) is a solid drawn-brass case 6.58 inches long; it has a capacity of 34.9 cubic inches and weighs, empty, 1.45 pounds. The head of the case has a projecting flange or rim under which the lip of the extractor engages. The center of the head is bored out to form a seat, into which the primer is forced. These primer seats are first mandreled to near the finished dimensions with a tapered steel plug to toughen the metal of the cartridge case around the primer seat and then reamed to finished size. This toughening is necessary to prevent expansion of the seats under gas pressure and consequent loose fit of the primers in subsequent firing. The primers are inserted in the case by the small primer-inserting press to avoid injury to the primer seat. Special decapping tools are also issued for use in removing exploded primers from cartridge cases.

#### THE PRIMER.

To insure the ignition of smokeless-powder charges in cartridge cases it is necessary that the primers either contain in themselves, in addition to the percussion composition, an auxiliary charge of black









powder, or that an auxiliary charge of such powder be placed at the rear of the cartridge case to communicate the flame from the percussion primer and thoroughly ignite the smokeless powder. The percussion primer, known as the "110-grain percussion primer," contains an igniting charge of 95 grains of black powder in addition to the essential elements of a percussion primer.

The "110-grain percussion primer" is shown in Plate IV, and consists of a brass case resembling in shape a small-arms cartridge case. The head or rear end of the primer case is countersunk, forming a cup-shaped recess, in which is seated the cap or percussion primer proper. The latter consists of the cup, the anvil, and the percussion composition, assembled as shown on Plate IV. The percussion composition is known as the "H-42" mixture, and contains the following ingredients:

	Per cent.
Chlorate of potash.....	47. 206
Tersulphide of antimony.....	30. 829
Flowers of sulphur.....	21. 965

The percussion-cap recess is connected with the interior of the primer case by a small vent. The body of the case contains 95 grains of black powder, constituting the rear "priming" or igniting charge for the smokeless powder. This black powder is inserted under a pressure of 30,000 pounds per square inch, and is pressed into the primer body around a central wire, which is then withdrawn, leaving a longitudinal hole the full length of the primer. Eight radial holes are drilled through the primer and compressed powder, affording 16 vents for the free exit of the black-powder flames. After filling the case the front end is closed by two cardboard wads, the end being crimped over the wads and the inside of the mouth covered with shellac. The radial perforations in the body of the case are covered by a tin-foil wrapper to retain in the case any loose black powder, as well as to exclude all moisture.

In action the blow of the firing pin explodes the percussion cap, which ignites the black powder; the flames of the latter shoot out through the vents in the primer case and ignite the smokeless-powder charge.

The primer just described is known as the "110-grain percussion primer," and is used only with smokeless-powder charges. A shorter primer, known as the "saluting primer percussion," is issued by the Ordnance Department for use in blank cartridges. The percussion elements and the dimensions of the seat in the cartridge case for both types of primers are identical. The primer charge of the saluting primer consists of 20 grains of loose rifle powder, held in place by a paper wad shellacked in the mouth of the primer case. The "20-grain saluting primers" are issued in hermetically sealed tin boxes,

25 in a box. The boxes should not be opened nor the cases primed until shortly before they are required for use.

The small primer-inserting press is provided for inserting box types of primers, which must be carefully pressed, and not hammered, into their seats in the cartridge cases. Special decapping tools are also issued for removing old primer cases from cartridge cases without injury to the latter.

#### THE POWDER CHARGE.

The powder is a nitrocellulose powder composed of single perforated cylindrical grains. In making up the cartridges, a brass diaphragm is placed in the mouth of the case on top of the powder charge and soldered fast, thus holding the powder charge in the rear position of the cartridge case in contact with the primer.

Smokeless powder *must not be used* for blank charges. For that purpose the Ordnance Department furnishes special powder for saluting purposes.

#### THE PROJECTILES.

The projectiles used in this gun are the 12½ and 18 pound cast-iron shell, 12½-pound steel shell, and the 12½-pound shrapnel.

The 12½-pound steel shell is 10.2 inches long. It has a capacity of 15.56 cubic inches, with fuze in place. It contains a bursting charge of 0.756 pound of T. N. T.

The medium-caliber base detonating fuze is used in this shell.

The 12½-pound cast-iron shell (Pl. IV) is 10.18 inches long, weighs 12½ pounds loaded and fuzed, has a capacity of 14.47 cubic inches, a bursting charge of 6.88 ounces of black powder, and is provided with a base percussion fuze, medium and major caliber.

The 18-pound cast-iron shell (Pl. IV) is 14.34 inches long, weighs 18 pounds loaded and fuzed, has a capacity of 20.69 cubic inches, a bursting charge of 9.92 ounces of black powder, and is provided with a base percussion fuze. Medium and major caliber shell of future manufacture will be of steel, loaded with high explosive and fuzed with detonating fuzes.

The manufacture of 18-pound projectiles has been discontinued.

#### COMMON SHRAPNEL.

The common shrapnel (Pl. IV) is a base-charged shrapnel fitted with the 21-second combination fuze. The case is of steel with solid base. The rotating band is forced into an annular groove cut in the case 1.2 inches from the base. The front or mouth of the case is closed by a steel head, screwed in and tapped to take the service combination time and percussion fuze. The bursting charge is composed

of loose black powder, covered by a steel diaphragm. The diaphragm supports a brass central tube which extends forward to the fuze, and thus affords a conduit for the flames from the fuze to the bursting charge. At the lower end of the central tube a stopper of dry gun-cotton is fitted to prevent the loose powder charge from getting into the tube and also to help ignite the bursting charge. The shrapnel filling is composed of 212 balls, each approximately 167 grains in weight. They are approximately 0.5 inch in diameter and are poured around the central tube and rest upon the steel diaphragm, the interstices containing a smoke-producing matrix.

In action the case is not ruptured upon the explosion of the bursting charge; the head is stripped and the balls are shot out of the case with an increase of velocity from 250 to 300 feet per second.

#### FRANKFORD ARSENAL COMBINATION FUZE, MODEL OF 1907 M.

This fuze consists of the following parts:

<i>a</i> Body, bronze.	<i>j</i> Compressed-powder pellet, in vent leading to lower time train.
<i>a'</i> Stop pin, brass.	<i>j'</i> Compressed-powder pellet in lower time-train vent.
<i>b</i> Closing cap, brass.	<i>k</i> Lower time train, compressed powder.
<i>b'</i> Vents in closing cap.	<i>l</i> Brass disk locked in place.
<i>c</i> Upper time-train ring, Tobin bronze.	<i>m</i> Compressed-powder pellet in vent <i>o</i> .
<i>c'</i> Washer for time-train ring, graduated, felt cloth.	<i>o</i> Vent leading to magazine.
<i>d</i> Time-train ring, graduated, Tobin bronze.	<i>p</i> Powder magazine.
<i>d'</i> Washer for body, felt cloth.	<i>q</i> Percussion plunger.
<i>d<sup>2</sup></i> Rotating pin, brass.	<i>r</i> Percussion primer.
<i>e</i> Concussion plunger.	<i>s</i> Vents leading from percussion primer to magazine.
<i>e'</i> Concussion-resistance ring, brass.	<i>u</i> Bottom closing screw, brass.
<i>g</i> Vent leading to upper time train.	<i>v</i> Washer for closing screw, muslin.
<i>h</i> Compressed-powder pellet.	<i>w</i> Washer for closing screw, brass.
<i>i</i> Upper time train, compressed powder.	

The body *a* of this fuze is machined from a bronze forging. The time-train rings *c* and *d* are turned from hard-rolled rods of Tobin bronze. An annular groove in the shape of a horseshoe is milled in the lower face of each of the time-train rings. Meal powder is compressed into these grooves under a pressure of 68,000 pounds per square inch, forming a time train, the total length of which is 9 inches.

The time element of this fuze is composed principally of the following parts: The time or concussion plunger *e*, the concussion-resistance ring *e'*, the firing pin, the vent *g*, leading to the upper time train, the compressed-powder pellet *h*, the upper time train *i*, the vent *j*, the lower time train *k*, the compressed-powder pellet *m* in the vent *o*, leading to the powder magazine *p*.



The plunger *e* is cylindrical in shape and contains the percussion composition in a recess at its base. The weight of the plunger rests upon the concussion-resistance ring *e'*, which keeps the primer from contact with the firing pin. At discharge of the gun the resistance of the ring is overcome and the primer is exploded by contact with the firing pin.

As stated above, the annular grooves into which the meal powder of the time train is pressed are in the shape of a horseshoe, a solid portion being left between the ends of the groove in each ring or disk.

The upper time-train ring *c* is prevented from rotating by pins which are halved into the fuze body and the inner circumference of the ring.

The vent *g* is drilled through the walls of the concussion-plunger chamber, and is exactly opposite a hole in the inner surface of the upper time train leading to the end of the train from which the direction of burning is anticlockwise.

The hole *j* is drilled through the upper face of the lower time-train ring *d* to the end of the lower time-train groove, from which the direction of burning is clockwise. The lower time-train ring is movable and is graduated on its outer edge in a clockwise direction from 0 to 21.2, each full division corresponding to one second time of burning in flight; these divisions are subdivided into five equal parts corresponding to one-fifth second. A radial pin *d*<sup>2</sup> is provided in the lower ring for engagement with a notch in the fuze setter for setting the fuze. A line on the lower flange of the fuze stock is the datum line for fuze settings.

The vent *o* is drilled through the flange of the fuze stock to the powder magazine *p*, and leads to the same end of the lower time train as the vent *j*—that end from which the direction of burning is clockwise—when the fuze is at its “zero” setting.

The action of the fuze as a time fuze is as follows:

Assuming the “zero” setting, at discharge of the gun the time plunger arms and fires its primer. The flame from the primer passes out through the vent *g*, igniting the pellet *h*, the end of the upper time train *i*, down through the vent *j*, to the end of the lower time train *k*, and thence through the vent *o* to the magazine *p*, the flame from which is transmitted to the base charge in the shrapnel. It will be seen that for the “zero” setting of the fuze the origins of both upper and lower time trains are in juxtaposition. Assume any other setting, say 12 seconds: The vent *j* has now changed its position with respect to the vent *h*, leading to the beginning of the upper time train, and the vent *o*, leading to the powder magazine *p*, both of which points are fixed by the angle subtended between the 0 and the 12-second settings. The flame

now passes out through vent *g* and burns along the upper time train in an anticlockwise direction until the vent *j* is reached, where it passes down to the beginning of the lower time train and burns back in a clockwise direction to the position of the vent *o*, whence it is transmitted by the pellet of compressed powder *m* to the powder magazine *p*.

For the 21.2-second setting the vent *j*, leading to the beginning of the lower time train, is opposite the end of the upper time train, and the end of the lower time train is opposite the vent *o*, leading to the powder magazine. It will now be seen that to reach the magazine *p* and burst the shrapnel the entire length of time train in both rings must be burned.

As already stated, the annular grooves in the lower face of each ring for the powder trains do not form complete circles, a solid portion being left between the ends of the grooves in each. This solid portion is utilized to obtain a setting at which the fuze can not be exploded, known as the "safety point."

This point is marked by a line on the outer edge of the movable time train, surmounted by an "S" and is located about halfway between the zero mark and the 21.2-second graduation. When this point is brought opposite the line on the lower flange of the fuze body the vent *j* is covered by the solid metal between the ends of the upper train, and the vent *o*, leading to the powder magazine *p*, is covered by the solid metal between the ends of the lower or movable time train.

At the safety setting it will be seen that the upper train may burn entirely out in case of accidental firing of the time plunger, or in case it may be desired to burst the shrapnel by impact or percussion without the flame being able to reach the magazine *p*.

The cloth washers *c'* and *d'* are glued to the upper face of the graduated time-train ring and to the upper face of the flange on the fuze stock. These surfaces are corrugated, as shown, to make the washers adhere more strongly. The function of the washers is to make a gas check and prevent premature action of the fuzes.

The compressed pellet *j'*, in the vent leading from the outside to the beginning of the lower time train, is to release the pressure of the gases due to the burning train. The gases from both time trains escape into the outer air through the annular spaces shown in the illustration and the vents *b'* in the closing cap.

The percussion element of this fuze as shown in the plate consists of a percussion plunger *q* and an ordinary percussion primer *r*.

The system of vents *s* through the walls of the fuze shown in figure 1 conduct the flame from the percussion primer to the magazine *p*.

The bottom closing screw closes the percussion-plunger recess and keeps the powder in the magazine. The muslin washer *v* is coated

with shellac and held in place by the brass washer *w*, over the outer edge of which a projecting lip is crimped.

These fuzes are issued assembled in shrapnel. For transportation the fuzes should always be set at the safety point.

The fuze is provided with a waterproof hood of thin brass, hermetically sealed. The hood should be stripped off before an attempt is made to set the fuze.

#### FRANKFORD ARSENAL COMBINATION FUZE, MODEL OF 1915.

[Plate V.]

The fuze consists of the following parts, assembled as shown in the drawing:

- |  |  |
|--|--|
| <i>a</i> Body, steel.  | <i>j</i> Compressed powder pellet in vent leading to lower time train. |
| <i>a'</i> Stop pin, brass.                                   | <i>j'</i> Compressed powder pellet in lower time-train vent.           |
| <i>b</i> Closing cap, steel.                                 | <i>k</i> Lower time train compressed powder.                           |
| <i>b'</i> Vents in closing cap.                              | <i>l</i> Brass disk, locked in place.                                  |
| <i>c</i> Upper time train ring, Tobin bronze.                | <i>m</i> Compressed powder pellet in vent <i>o</i> .                   |
| <i>c'</i> Washer for time train ring, graduated, felt cloth. | <i>o</i> Vent leading to magazine.                                     |
| <i>d</i> Time train ring graduated, Tobin bronze.            | <i>p</i> Powder magazine.  |
| <i>d'</i> Washer for body, felt cloth.                       | <i>q</i> Percussion plunger, brass.                                    |
| <i>d<sup>2</sup></i> Rotating pin, brass.                    | <i>q'</i> Percussion plunger sleeve, brass.                            |
| <i>e</i> Concussion plunger.                                 | <i>q<sup>2</sup></i> Restraining spring, brass.                        |
| <i>e'</i> Concussion resistance ring, brass.                 | <i>r</i> Concussion primer.  |
| <i>f</i> Concussion firing pin, brass.                       | <i>s</i> Vent leading from percussion primer to magazine.              |
| <i>f'</i> Safety pellet, compressed powder.                  | <i>t</i> Percussion firing pin, German silver.                         |
| <i>f<sup>2</sup></i> Safety cap, brass.                      | <i>u</i> Bottom closing screw, brass.                                  |
| <i>g</i> Vent leading to upper time train.                   | <i>v</i> Washer for closing screw, muslin.                             |
| <i>h</i> Compressed powder pellet.                           | <i>w</i> Washer for closing screw, brass.                              |
| <i>i</i> Upper time train ring, compressed powder.           | <i>w'</i> Bottom closing screw disk, paper.                            |

The time element of this fuze is exactly like that of the model of 1907 M, the time-train rings and concussion plunger being the same and the closing cap the same, with the exception that it is made of steel for the model of 1915, where in the model of 1907 M it is made of brass.

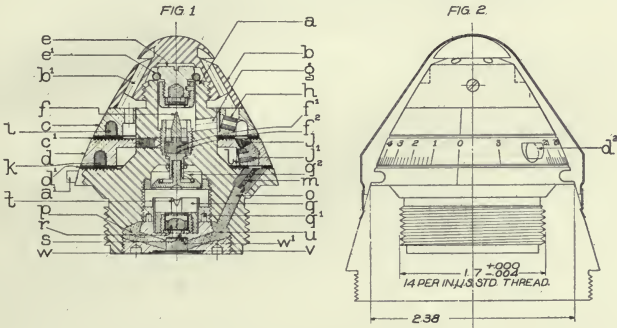
The action of the fuze as a time fuze is exactly like the model of 1907 M, described previously.

The action of the fuze as a percussion fuze is as follows:

When the gun is fired, and the concussion or time plunger *e* fires its primer, the flame besides passing through the vent *g* and igniting the upper time train, also passes through the four holes in the concussion firing pin *f* and ignites the safety pellet *f'*. When this burns out completely, the percussion plunger *q* is free to move forward in its sleeve *q'*, carrying the percussion primer *r* with it.

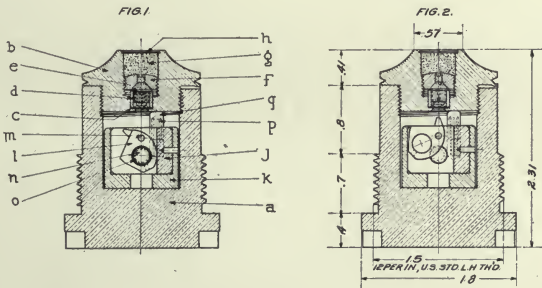


21 SECOND COMBINATION FUZE-MODEL OF 1915.



36-23-93

BASE PERCUSSION FUZE, MEDIUM AND MAJOR CALIBER.



36-23-93



The restraining spring  $q^2$  prevents the percussion plunger from creeping forward during the flight of the projectile and on impact the plunger flies forward, overcoming the resistance of the spring and the primer is exploded by the firing pin  $t$ . The flame passes through the vent  $s$  to the powder magazine  $p$ . The paper disk  $w'$  keeps the powder in the magazine from entering the percussion plunger cavity.

#### BASE PERCUSSION FUZE, MEDIUM AND MAJOR CALIBER.

[Plate V.]


The fuze consists of the following parts assembled as shown in the drawing:

<i>a</i> Body, brass.	<i>j</i> Plunger brass.
<i>b</i> Closing cap screw, brass.	<i>k</i> Plunger housing, brass.
<i>c</i> Primer shield, brass.	<i>l</i> Firing pin, brass.
<i>d</i> Primer body, brass.	<i>m</i> Firing-pin fulcrum, steel.
<i>e</i> Primer disk, paper.	<i>n</i> Safety pin, brass.
<i>f</i> Primer closing screw, brass.	<i>o</i> Safety-pin spring, brass.
<i>g</i> Reinforcing charge, loose shrapnel powder.	<i>p</i> Restraining spring, brass.
<i>h</i> End closing disk, brass.	<i>q</i> Restraining-spring housing, brass.

The plunger  $j$  is provided with a slot to receive the firing pin  $l$ , which is mounted on the fulcrum  $m$  and kept in the unarmed position, figure 1, by two safety pins  $n$ , in recesses on opposite sides of the plunger and held in the hole in the firing pin by the tension of the springs  $o$ . These springs are designed to suit the velocity of rotation of the particular projectile in which the fuze is used. The centrifugal force due to the rotation of the projectile forces the pins outward against the tension of the springs and releases the firing pin, which is rotated by the same centrifugal force into its armed position, figure 2. The entire plunger and housing is held to the rear by two springs  $p$ , pressing on the closing screw through the housing  $q$ .

#### MARKING ON AMMUNITION PACKING BOXES.

Both ends and sides of the box are marked with conspicuous characters to facilitate the rapid identification of the ammunition contained therein. The conspicuous marking consists of the following symbols:

 2.95G


The ordnance escutcheon is always in red for mobile artillery ammunition. The numerals 2.95 refer to the caliber and the letter G to the gun. The numerals 2.95 and the letter G are in yellow for common shrapnel, black for common steel shell, and blue for blank ammunition.

In addition to the conspicuous marking, the quantity and type of ammunition are indicated without symbols by the marking "4 fixed common shrapnel," etc., so that in case one is not familiar with the conspicuous marking system he can immediately ascertain the key by this additional marking.

Also on both ends and sides of the box the "Lot" followed by a number appears. This refers to the ammunition lot, and in case of any trouble arising with regard to the functioning of the ammunition, this lot number should be quoted in the report.

On the sides of the box in addition to the marking described is found a pictorial stenciled symbol indicating the type of projectile and the fact that the ammunition is fixed.

When shot is packed the conspicuous marking is as follows:

 2.95Z3

The entire marking in this case is black. The numerals 2.95 refer to the caliber, the letter "Z," zone, and the numerals 1, 2, or 3 following the "Z," the fact that one zone, two zones, or three zones are used.

On the top of the box near one end is stamped a general description of the contents, as "Ammunition for cannon with explosive projectile," when the projectiles are of the explosive type, as shell or shrapnel; "Ammunition for cannon with empty projectiles," for shot; and "Ammunition for cannon without projectiles," for blank ammunition. To one side of this stamping appears the seal of the post where packed and the inspector's stamp.

#### BLANK AMMUNITION.

Blank metallic ammunition is for use in salute firing, morning and evening gun firing, maneuver firing, etc., and consists of the following components: A brass cartridge case, a percussion primer, a charge of black powder, cloth powder bags, and a tight-fitting felt wad.

The powder charge is contained in a cloth bag, which is placed in the case after the primer is inserted and then the wad is inserted and sealed. This is to prevent any powder from leaking out in the event of the dislodgement of the wad, due to rough handling in transportation or jolting in the caissons and limbers.

#### THE CARTRIDGE CASE.

The cartridge case for blank ammunition is identical with the service cartridge case. Cartridge cases are issued unprimed, and primers should not be inserted until the ammunition is to be prepared for use.

Cartridge cases that have become deformed in service should be turned in to the posts or arsenals designated in current orders for resizing and re-forming.



## THE PRIMER.

The saluting primer (percussion) is used in the preparation of blank metallic ammunition. The primer should be a tight fit in the primer seat in the cartridge case, and must be pressed into place with the primer-inserting press provided for the purpose, and not hammered in. No primer should be used that is not a tight fit in its seat in the case.

Cartridge cases should be primed just before the insertion of the powder charge, and under no circumstances will primers be inserted after the powder charge has been inserted.

Primers are issued in hermetically sealed tin boxes, which should not be broken open until the primers are to be used, as they deteriorate when exposed to atmospheric influences.

## THE CHARGE.

The charge to be used in the preparation of blank metallic ammunition for the 2.95-inch mountain gun is 1 pound 2 ounces of saluting powder.

## PREPARATION OF BLANK METALLIC AMMUNITION.

Blank metallic ammunition will be assembled at posts or in the field under the personal supervision of a commissioned officer, who will be held responsible that it is prepared in the manner prescribed in orders.

For this purpose there are issued blank-cartridge cases, black powder in bulk, cloth powder bags, tight-fitting felt wads, rubberine or other quick-drying paint, primers, etc.

When saluting powder is issued in bulk for use in blank cartridges, the bags should be requisitioned for separately and should be separately invoiced.

Before assembling, the cartridge cases should be carefully inspected to see that they are in sound condition and thoroughly clean and dry. They should also be tested by trying them in the gun, to determine whether they have become deformed. Any cases that do not readily enter the chamber in the gun or that are otherwise seriously deformed should be laid aside for resizing. After inspecting the cartridge cases the blank ammunition should be prepared as follows:

(a) Insert the primers with the primer-inserting press.

(b) Pour the proper weight of powder into the cloth bag and tie up the mouth of the bag with string. Before inserting in the case, see that the opening in the bottom of the bag is free to allow it to settle around the primer.

In tying the bag, use no more string and leave no more cloth in the "choke" than necessary and place the bag in the case with the "choke" end toward the mouth of the case.

(c) Insert the felt wad and press it down hard until it rests squarely on the powder charge.

(d) Give the upper surface of the felt wad and the inside of the cartridge case just above the wad a good coat of the rubberine or other quick-drying paint furnished for the purpose, using a brush, and allow the case to stand until this coat is dry. Then apply another coat of rubberine paint in a similar manner. The object of using rubberine paint, which is strongly adhesive, is to thoroughly seal the joint between the wad and the case and at the same time to firmly hold the wad in place.

#### PRECAUTIONS TO BE OBSERVED.

Firings with blank metallic ammunition will be greatly facilitated by a careful observance of the following:

Before all firings a careful examination should be made of the assembled rounds to see that the felt wads have not become displaced or the cartridge cases dented or deformed by careless handling. If the cartridge cases have been properly resized and are clean, no difficulty should be experienced in inserting them in the gun, provided the chamber of the latter is clean. The continued insertion of cartridge cases that are not clean causes an accumulation in the gun chamber which may make the insertion of subsequent rounds difficult or impossible.

In firing blank ammunition the gun chamber will be sponged after each round with a damp sponge, to extinguish sparks and remove powder residue resulting from the previous round, before the insertion of another round.

Care will be taken to see that the sponges are not worn and that they thoroughly fit the chamber. The interval between rounds in firing blank ammunition should be sufficient to allow thorough sponging of the chamber and examination to ascertain that all sparks have been extinguished.

Wads for the preparation of blank metallic ammunition are made to tightly fit in the cartridge case. No wads should be used that are not a tight fit in the case.

#### CARE OF CARTRIDGE CASES.

As soon after firing as practicable the exploded primers should be removed from the cartridge case by means of the decapping tool furnished with the reloading outfit. The case should then be thoroughly washed in a strong solution of soft soap and soda to remove all powder residue. It should then be thoroughly dried.

Before firing a salute with blank metallic ammunition all the cartridges to be used should be inserted in the gun to ascertain if they will fit. In preparing ammunition for salutes, a few rounds in addi-



tion to the required number should be prepared for use in case of misfires. Lightly oiling the outside of cartridge cases just before use will facilitate their insertion and extraction.

If the cartridge cases are carefully cleaned and washed immediately after firing, not only will less labor be required, but the life of the cartridge case will be greatly prolonged.

A good solution for washing cartridge cases may be prepared by using ingredients in the following proportions: 1 gallon of water, 2½ ounces soft soap, 5½ ounces soda. The mixture should be boiled and stirred until the ingredients are entirely dissolved.

In washing cartridge cases this solution should be used hot and in sufficient quantity to completely immerse the cases.

Neither acids nor solutions of acids will be used for cleaning cartridge cases.

#### THE RELOADING AND CLEANING OUTFIT.

This outfit consists of the following parts, and is furnished to each battery and to each post where saluting is necessary:

Primer-inserting press, small.	} Class V, Section 5.
Bushing.	
Powder measure, saluting.	
Decapping tool, with guide.	
Cleaning brush.	
Hammer, bronze.	
Case holder.	
Case-holder stand.	
Storage chest.	

The bushing is used in the primer-inserting press for the insertion of new primers.

The decapping tool and case holder and stand are used for removing exploded primers from the cartridge cases. A light blow on the rod with a piece of wood or the bronze hammer generally removes the primer.

A powder measure to suit the saluting charge for the gun is furnished, and when level full holds the required charge.

The cleaning brush is furnished for cleaning the cartridge cases after they have been used and should be ordered to suit the size of case for which intended.

#### MISFIRES AND HANGFIRES.

“Misfires” and “hangfires” are of exceedingly rare occurrence with this ammunition. In case of the failure of the cartridge to fire when the trigger is pulled, the breechblock *should not be opened* until after the expiration of at least one minute. The gun may be immediately recocked without opening the breech mechanism and the cartridge tried again. Defective cartridges and primers should be reported.

## THE HAND FUZE SETTER, MODEL OF 1905 M.

[Plate VI.]

The fuze setter is a device for rapid and accurate setting the fuze for various ranges and heights of burst. Two hand fuze setters in leather cases are issued for each gun.

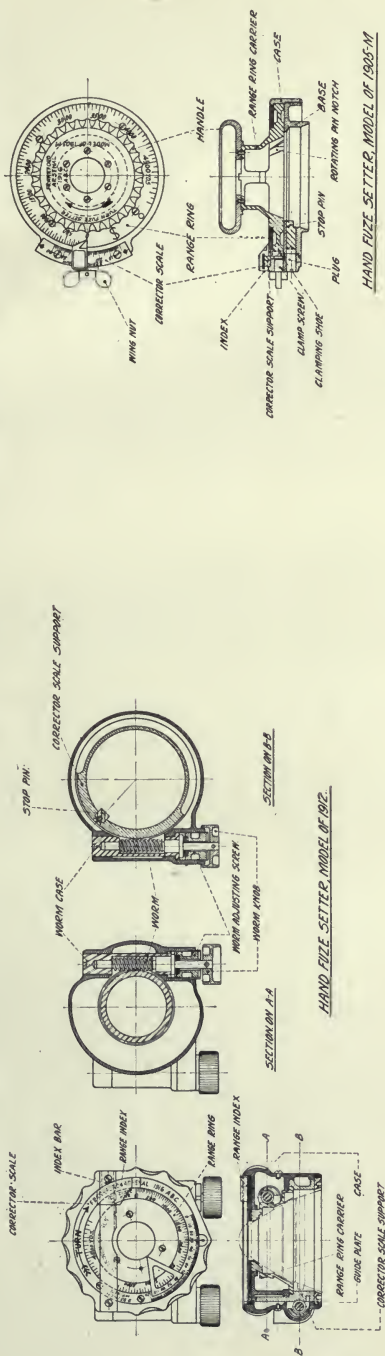
The names of the parts of the hand fuze setter and the manner in which they are assembled are shown in plate.

While the rate of burning of different fuzes of the same lot will be found uniform, it may vary slightly from that upon which the fuze setter range-ring scale is based. The amount of this variation at different ranges must be determined by trial and allowed for. This allowance, with correction for error in determining angle of site, etc., and regulation of height of burst of shrapnel, is made on the corrector scale. In use the battery commander indicates the corrector reading desired. Should the height of burst of the shrapnel not be that desired, it is increased or diminished by increasing or decreasing the corrector-scale reading on the fuze setter. When the height of burst has been adjusted for one range, the range may be increased or diminished in order to sweep the ground in depth without altering the corrector.

A new design of corrector scale with sliding index has been adopted and will be issued to replace all of the old design. In use, the range and corrector setting having been ordered, the sliding index is set at the designated corrector setting and the graduation line corresponding to the range is set opposite the fiducial edge of the index. This will require that whenever the corrector or range is changed the fuze setter must be unclamped and a new setting made.

To use the hand fuze setter, loosen the clamp screw, set the range ring at the range and correction ordered, and clamp; remove the waterproof cover of the fuze; place the fuze setter over the point of the projectile and turn in a clockwise direction until the rotating pin of the fuze engages in the notch provided for it; then press firmly down on the fuze setter and continue to turn in a clockwise direction until the stop pin in the fuze setter engages with the fixed stop pin in fuze body and prevents further rotation. Especial care must be taken to rotate the fuze setter in a *clockwise* direction.

The hand fuze setter should be disassembled from time to time and thoroughly cleaned and oiled. To disassemble: Remove the corrector-scale mechanism, unscrew the clamp screw, remove the clamp shoe; remove plug; unscrew the base from the case; withdraw the range-ring carrier, with range ring and handle, from the case. Clean thoroughly, oil, and assemble in reverse order.



HAND FUZE SETTER, MODEL OF 1912.

HAND FUZE SETTER, MODEL OF 1905-M





For setting the 15-second combination fuze, a number of which are still in the service, a suitable punch is provided. With this punch a hole is made through the cover, time train, and lead cone of the fuze at the point corresponding to the number of seconds desired.

*Range table for 2.95-inch mountain gun.*

PROJECTILE, 12½ POUNDS. MUZZLE VELOCITY, 920 FEET PER SECOND.

Range.	Angle of elevation.		$\Delta x$ for $\pm \Delta l$ elevation.		$\Delta x$ for $\Delta \pm 10$ f. s. m. v.	$\Delta x$ for wind, 10 m. p. h.	$\Delta x$ for change of $\pm$ to C.	Time of flight.	Drift.	Deflection for cross wind, 10 m. p. h.		Angle of departure.		Slope of fall.	Terminal velocity.	Maximum ordinate.	Values of "C."	Values of $\beta_c$ fa
Yds.	°	'	Yds.	Yds.	Yds.	Yds.	Secs.	Mils.	Mils.	°	'	1 on—	f. s.	Feet.				
100	13	5.0	2.2	0	0.1	0.3	0.02	0.05	0.05	20	144.5	914	1					
200	33	5.0	4.4	0	.2	.6	.05	.10	.10	40	76.4	908	2					
300	53	5.0	6.6	.1	.3	.9	.09	.15	.15	1 00	51.3	902	4					
400	1 13	5.0	8.7	.2	.5	1.2	.14	.21	.21	1 20	38.2	896	7					
500	1 33	5.0	10.8	.3	.8	1.6	.2	.27	.27	1 40	30.4	890	11					
600	1 53	4.9	12.9	.4	1.1	1.9	.3	.32	.32	2 00	25.3	884	16					
700	2 14	4.8	14.9	.5	1.5	2.3	.4	.38	.38	2 21	21.6	878	22					
800	2 35	4.7	16.9	.7	1.9	2.6	.4	.44	.44	2 42	18.8	871	28					
900	2 57	4.6	18.8	.9	2.4	3.0	.5	.50	.50	3 4	16.5	865	36					
1,000	3 19	4.5	20.7	1.1	3.0	3.4	.6	.56	.56	3 26	14.6	859	46			2.328	0.617	
100	3 41	4.4	22.5	1.3	3.8	3.7	.7	.63	.63	3 48	13.2	852	57					
200	4 4	4.3	24.3	1.5	4.7	4.0	.9	.70	.70	4 11	12.0	845	68					
300	4 27	4.3	26.0	1.8	5.8	4.4	1.0	.77	.77	4 34	11.0	838	80					
400	4 51	4.2	27.7	2.2	7.0	4.8	1.2	.85	.85	4 58	10.1	831	94					
500	5 15	4.2	29.3	2.7	8.4	5.2	1.3	.93	.93	5 22	9.4	824	109					
600	5 39	4.2	30.9	3.3	9.9	5.5	1.5	1.02	1.02	5 46	8.7	816	125					
700	6 3	4.1	32.4	4.0	11.6	5.9	1.6	1.11	1.11	6 10	8.1	809	142					
800	6 27	4.1	33.9	4.8	13.5	6.3	1.8	1.20	1.20	6 34	7.6	802	161					
900	6 52	4.0	35.4	5.8	15.6	6.7	2.1	1.30	1.30	6 59	7.1	794	182					
2,000	7 17	3.9	36.8	6.9	17.9	7.1	2.3	1.41	1.41	7 24	6.7	786	205			1.877	.765	
100	7 43	3.8	38.2	8.1	20.4	7.5	2.6	1.52	1.52	7 50	6.3	778	229					
200	8 10	3.7	39.6	9.5	23.0	7.9	2.9	1.63	1.63	8 17	6.0	770	254					
300	8 38	3.6	40.9	11.0	25.7	8.3	3.2	1.75	1.75	8 45	5.7	762	281					
400	9 6	3.5	42.2	12.6	28.5	8.8	3.5	1.88	1.88	9 13	5.4	754	310					
500	9 35	3.4	43.5	14.3	31.4	9.2	3.9	2.01	2.01	9 42	5.1	746	342					
600	10 5	3.3	44.7	16.1	34.4	9.6	4.3	2.14	2.14	10 12	4.8	738	376					
700	10 36	3.2	45.9	18.0	37.5	10.1	4.7	2.28	2.28	10 43	4.5	729	413					
800	11 8	3.1	47.1	20.0	40.7	10.6	5.1	2.42	2.42	11 15	4.3	721	452					
900	11 41	3.0	48.2	22.0	44.0	11.0	5.6	2.56	2.56	11 48	4.0	713	494					
3,000	12 15	2.9	49.3	24.1	47.5	11.5	6.1	2.70	2.70	12 22	3.8	705	539			1.587	.905	
100	12 50	2.8	50.4	26.2	51.1	12.0	6.6	2.84	2.84	12 57	3.6	696	587					
200	13 26	2.7	51.5	28.8	54.8	12.5	7.1	2.98	2.98	13 33	3.4	688	638					
300	14 3	2.7	52.6	31.1	58.6	13.0	7.7	3.12	3.12	14 10	3.2	680	692					
400	14 41	2.6	53.7	33.5	62.5	13.5	8.3	3.26	3.26	14 48	3.0	672	749					
500	15 20	2.5	54.7	36.0	66.5	14.0	8.9	3.40	3.40	15 27	2.9	665	809					
600	16 00	2.5	55.7	38.6	70.6	14.6	9.5	3.54	3.54	16 7	2.7	658	873					
700	16 41	2.4	56.7	41.3	74.8	15.2	10.2	3.68	3.68	16 48	2.6	652	941					
800	17 23	2.4	57.7	44.2	79.0	15.8	10.9	3.82	3.82	17 30	2.5	646	1,014					
900	18 6	2.3	58.7	47.3	83.3	16.4	11.6	3.96	3.96	18 13	2.3	641	1,093					
4,000	18 51	2.2	59.6	50.6	87.6	17.1	12.3	4.11	4.11	18 58	2.2	636	1,179			1.426	1.007	
100	19 38	2.1	60.6	54.1	91.9	17.7	13.1	4.25	4.25	19 45	2.1	632	1,271					
200	20 27	2.0	61.6	57.8	96.3	18.4	13.9	4.40	4.40	20 34	2.0	628	1,369					
300	21 18	1.9	62.6	61.7	100.7	19.0	14.7	4.55	4.55	21 25	1.9	625	1,473					
400	22 10	1.9	63.5	65.8	105.1	19.7	15.6	4.70	4.70	22 17	1.8	622	1,583					
500	23 4	1.8	64.5	70.1	109.5	20.4	16.5	4.84	4.84	23 11	1.7	619	1,699					
600	24 0	1.8	65.4	74.6	114.0	21.1	17.4	4.99	4.99	24 7	1.7	617	1,821					
700	25 57	1.7	66.3	79.2	118.5	21.8	18.3	5.14	5.14	25 4	1.6	615	1,948					
800	25 56	1.7	67.2	83.9	123.0	22.5	19.3	5.28	5.28	26 3	1.5	613	2,280					
900	26 57	1.6	68.1	88.8	127.5	23.3	20.3	5.44	5.44	27 4	1.4	612	2,317					
5,000	27 59	1.6	69.0	93.9	132.0	24.1	21.3	5.58	5.58	28 6	1.3	611	2,360			1.421	1.010	

## HAND FUZE SETTER, MODEL OF 1912.

[Plate VI.]

The hand fuze setter is provided for the same purpose as the hand fuze setter, model of 1905 M. Plate VI shows assembled and sectional views and designation of parts. The principal parts are the case, the range-index mechanism, range mechanism, correction mechanism, and guide plate.

The case forms a housing for the movable parts and provides seats for the worm cases and the index bar. The slot cut in the top of the case limits the movement of the projecting segment of the corrector-scale support, which carries the corrector scale. The serrated rim forms a handle for turning. The arrow engraved upon the top and the lower center edge of the case coincides with the graduations of the corrector scale. Two oil-hole screws are located in the case directly under the serrated rim on both right and left sides and identified by the word "Oil."

The range-index mechanism consists principally of the index bar, range index, index plunger, and index spring. The index bar is retained in its seat, located in the case directly above the range ring and corrector scale, by two index-bar screws, and forms a slide for the range index. The V-shaped notches in the index bar are marked with numbers 1, 2, and 3, with the word "Zone." The range index sliding upon the index bar is held in position by the index spring, forcing the index plunger into the V-shaped notches of the index bar.

The range mechanism consists principally of the range ring, range-ring carrier, worm, worm case, worm-adjusting screw, and worm knob.

The correction mechanism consists principally of the corrector scale, corrector-scale support, worm, worm case, worm-adjusting screw, and worm knob.

The range ring is located upon the range-ring carrier by a steel dowel pin and secured in position by three range-ring screws. The scale is graduated for a range of 4,900 yards, least division is 50 yards, and numbered every 500 yards.

The data for graduating the range ring is computed from actual corrected firings, and then corrected for a suitable height of burst of 3 mils. The graduated surface is sandblasted and lacquered.

The corrector scale is mounted upon the projected segment of the corrector-scale support and secured by two corrector-scale screws. On this scale is graduated 120 equal divisions, 50 minutes apart, numbered every 10 divisions. Graduation numbered 30 is the normal or zero position, and is indicated by an arrow. The word "Turn" and an arrow engraved upon the corrector scale indicates the direction the fuze setter must be turned when setting a fuze. A pointer



is riveted and soldered to the top of the corrector scale in a certain position to coincide with the graduated line on the closing cap of the fuze.

The range-ring carrier is seated in the corrector-scale support. The worm teeth mesh with the threads of the worm on the right side of the fuze setter. The slot, which is cut in the bottom side of the range-ring carrier, engages with the rotating pin in the graduated time train ring of the fuze. The interior is conical in shape, to suit the exterior of the fuze.

The corrector-scale support is held within the case by the guide plate. The worm teeth mesh with the threads of the worm on the left side of the fuze setter. The movement of the corrector-scale support is limited in both directions by the slot in the case. The stop pin is secured in the interior of the corrector-scale support by the stop-pin screw, and engages with the fixed stop pin in the body of the fuze to limit the movement of the fuze setter.

The worms are mounted eccentrically in the worm cases, which, when turned, provides an adjustment to take up the wear between the worm teeth of the range-ring carrier or corrector-scale support and the threads of their respective worm. The worm cases have screw-driver slots at their rear ends, which are provided for adjusting, and are locked in position by the worm-case clamp plugs, which are secured by the worm-case clamp screws. The worm-adjusting screws have fiber washers fitted in their ends that bear upon the collars of the worms for taking up end motion and to provide sufficient friction to resist accidental turning. A screw-driver slot is located at their front end for adjusting. The worm-adjusting screws are locked in position by the worm-adjusting screw clamp plugs which are secured by the worm-adjusting screw clamp screws. The worm knobs are secured to the worms by taper pins. The exterior of the worm knobs is straight knurled to facilitate turning. The guide plate is screwed in its threaded seat in the bottom of the case and retained in position by the guide-plate lock screw.

#### DISASSEMBLING AND ASSEMBLING.

To disassemble, remove the index-bar mechanism, which is held in place by two index-bar screws. Take out the three range-ring screws and the two corrector-scale screws and remove the range ring and the corrector scale. Remove the guide-plate lock screw and unscrew the guide plate, using a teat wrench. To remove the worm knobs from the worms, drive out the taper pins. Loosen the worm-adjusting screw clamp screws, which release the worm-adjusting screw clamp plugs. Remove the worm-adjusting screws. The worms can now be removed by turning. The corrector-scale support

and range-ring carrier can then be removed. To remove the worm cases, loosen the worm-case clamp screws, which release the worm-case clamp plugs.

Assemble in reverse order.

#### ADJUSTMENT.

Backlash or lost motion may appear between the collars of the worms and the fiber washers endwise; between the worm teeth of the range-ring carrier or the corrector-scale support and the threads of their respective worms.

To remove the end backlash, loosen the worm-adjusting screw clamp screw, which releases the worm-adjusting screw clamp plug; then turn the worm-adjusting screws clockwise, using a screw driver, until the end play is removed and there is sufficient friction to prevent accidental turning of the worms. The worm-adjusting screw clamp plugs must be firmly clamped after adjusting by tightening the worm-adjusting screw clamp screws, which secures the worm-adjusting screws against rotation.

Should backlash appear between the worm teeth of the range-ring carrier or the corrector-scale support and the threads of their respective worms, it can readily be removed by loosening the worm-case clamp screws, which release the worm-case clamp plugs, and then turning the worm cases, using a screw driver in the slot at the rear end, in which the worms are eccentrically mounted, so as to bring the worms in closer contact with the worm teeth. The worm-case clamp plugs must be firmly clamped after adjusting by tightening the worm-case clamp screws which secures the worms cases against rotation.

#### OPERATION.

First. Turn the worm knob, pinned to the worm and located at the front-right side of the fuze setter, until the desired range on the range ring registers with the range index.

Second. Turn the worm knob, pinned to the worm and located at the front-left side of the fuze setter, until the graduated line on the corrector scale, which indicates the desired correction for height of burst, registers with the engraved arrow on the case.

The graduation, numbered 30 and indicated by an arrow head, is the normal height of burst under normal conditions. A decreased reading on the corrector scale decreases the height of burst and increases the range, and increased reading increases the height of burst and shortens the range.

To set a fuze, remove the waterproof cover, place the fuze setter over the fuze and turn until the slot in the bottom of the range-ring carrier engages with the rotating pin in the graduated time train

ring of the fuze. The guide plate and conical interior of the ranging carrier will then rest upon the fuze. Turn the fuze setter clockwise, as indicated by the arrow on the corrector scale, until the stop pin fastened to the corrector-scale support engages with the fixed stop pin in the body of the fuze and further motion is prevented.

The pointer, which is attached to the top of the corrector scale, should register with the graduated line on the closing cap, to indicate that the stop pin of the fuze setter and the fixed-stop pin of the fuze are in contact. This pointer is added as the graduated time train ring of the fuze has tendency to stick or to bind to such a degree as to indicate that the stop pin of the fuze setter and the fixed-stop pin of the fuze are in contact.

Cards for recording the results of tests of the fuze setters are furnished by the Ordnance Department for each size of gun, howitzer, or mortar, on which computed problems of inspection are given as indicated below. The examples given below are for 2.95-inch mountain gun. The cards for other calibers are similar.

Range ring.	Corrector scale.	Computed fuze settings.	Fuze settings.	
			Measure.	Error.
0	30	0	.....	.....
2000	4	7.84	.....	.....
3750	45	13.43	.....	.....
4900	30	20.95	.....	.....

To check the fuze setter, set the range ring and corrector scale to that tabular readings. Set the fuze with the fuze setter and compare the results with the computed setting in the table. Use shrapnel and not a drill cartridge in making this test. When the range index registers with 0 on the range ring and the corrector scale at 30, the fuze is set at 0, and will explode immediately on leaving the gun. When setting a fuze to explode on impact, set the range index at S and the corrector scale at 30.

#### CARE AND PRESERVATION.

The interior of the fuze setter can be oiled by removing the oil-hole screws; the locations are identified by the word "oil."



## Range table for 2.95-inch mountain gun.

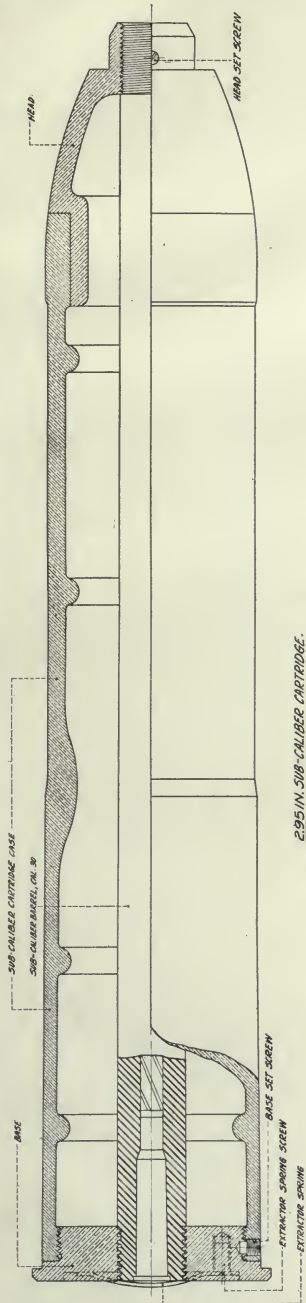
PROJECTILE, 18 POUNDS. MUZZLE VELOCITY, 750 FEET PER SECOND.

Range.	Angle of elevation.	$\Delta x$ for $\pm \Delta \gamma$ elevation.	$\Delta x$ for $\pm C10$ f. s. m. v.	$\Delta x$ for wind 10 m. p. h.	$\Delta x$ for change of $\pm \rho_c$ .	Time of flight.	Drift.	Deflection for cross wind, 10 m. p. h.	Angle of departure.	Slope of fall.	Terminal velocity.	Maximum ordinate.	Values of "C."	Values of $\rho_c$ fa.
<i>Yds.</i>	<i>° ' "</i>	<i>Yds.</i>	<i>Yds.</i>	<i>Yds.</i>	<i>Yds.</i>	<i>Secs.</i>	<i>Mils.</i>	<i>Mils.</i>	<i>° ' "</i>	<i>in.</i>	<i>f. s.</i>	<i>Feet.</i>		
100....	22	3.5	2.5	0.0	0.1	0.3	0.09	0.01	29	118.5	749	2		
200....	51	3.5	5.0	.0	.2	.6	.2	.01	58	59.3	748	7		
300....	1 20	3.5	7.6	.1	.3	1.0	.3	.02	1 27	39.5	747	12		
400....	1 49	3.4	10.1	.1	.5	1.4	.4	.03	1 56	29.4	746	18		
500....	2 19	3.4	12.7	.2	.6	1.7	.5	.04	2 26	23.4	745	24		
600....	2 49	3.3	15.2	.2	.8	2.1	.6	.05	2 56	19.4	744	31		
700....	3 19	3.3	17.8	.3	1.0	2.5	.8	.06	3 26	16.5	743	38		
800....	3 50	3.2	20.3	.4	1.2	2.9	1.0	.07	3 57	14.4	741	46		
900....	4 21	3.2	22.9	.5	1.5	3.2	1.2	.09	4 28	12.7	739	56		
1,000....	4 52	3.1	25.4	.6	1.8	3.6	1.4	.11	4 59	11.3	738	67	8.915	0.232
100....	5 24	3.1	28.0	.7	2.1	4.0	1.6	.13	5 31	10.3	736	80		
200....	5 56	3.1	30.6	.9	2.5	4.4	1.8	.15	6 3	9.4	734	95		
300....	6 28	3.1	33.2	1.1	2.9	4.8	2.1	.17	6 35	8.6	732	112		
400....	7 00	3.0	35.8	1.3	3.3	5.2	2.4	.20	7 7	7.9	729	130		
500....	7 32	3.0	38.4	1.6	3.7	5.7	2.8	.23	7 39	7.3	727	150		
600....	8 4	3.0	41.0	1.9	4.2	6.2	3.2	.26	8 11	6.8	724	172		
700....	8 37	3.0	43.6	2.2	4.8	6.6	3.6	.30	8 44	6.4	722	196		
800....	9 10	2.9	46.2	2.5	5.4	7.0	4.0	.34	9 17	6.0	719	222		
900....	9 43	2.9	48.7	2.8	6.1	7.5	4.4	.38	9 50	5.6	716	250		
2,000....	10 16	2.9	51.2	3.2	6.9	8.0	4.8	.43	10 23	5.3	713	280	3.471	.378
100....	10 50	2.8	53.6	3.6	7.7	8.5	5.3	.48	10 57	5.0	710	311		
200....	11 25	2.8	56.0	4.1	8.6	9.0	5.8	.54	11 32	4.7	707	344		
300....	12 1	2.8	58.3	4.6	9.5	9.5	6.4	.60	12 8	4.4	704	379		
400....	12 38	2.7	60.6	5.2	10.5	10.0	7.0	.67	12 45	4.2	700	416		
500....	13 16	2.7	62.9	5.8	11.6	10.5	7.7	.74	13 23	4.0	697	456		
600....	13 55	2.6	65.1	6.5	12.8	11.0	8.4	.82	14 2	3.8	693	499		
700....	14 34	2.5	67.3	7.3	14.0	11.6	9.1	.90	14 41	3.6	689	545		
800....	15 15	2.4	69.5	8.2	15.3	12.1	9.8	.98	15 22	3.4	686	594		
900....	15 57	2.4	71.6	9.2	16.7	12.6	10.5	1.06	16 4	3.2	682	647		
3,000....	16 40	2.3	73.7	10.3	18.3	13.2	11.2	1.14	16 47	3.1	678	703	3.954	.523
100....	17 24	2.3	75.7	11.5	20.0	13.8	12.0	1.23	17 31	2.9	674	763		
200....	18 10	2.2	77.7	12.8	21.8	14.3	12.8	1.32	18 17	2.8	671	827		
300....	18 58	2.1	79.7	14.2	23.7	14.9	13.6	1.42	19 5	2.7	667	895		
400....	19 48	2.0	81.6	15.8	25.7	15.5	14.5	1.52	19 55	2.5	663	968		
500....	20 39	1.9	83.5	17.5	27.8	16.1	15.4	1.62	20 46	2.4	660	1,046		
600....	21 32	1.9	85.4	19.3	30.0	16.8	16.3	1.72	21 39	2.3	656	1,129		
700....	22 37	1.8	87.2	21.2	32.4	17.4	17.3	1.82	22 34	2.2	652	1,218		
800....	23 24	1.7	89.0	23.2	34.9	18.1	18.3	1.92	23 31	2.1	648	1,313		
900....	24 23	1.7	90.8	25.3	37.4	18.8	19.4	2.02	24 30	2.0	645	1,414		
4,000....	25 24	1.6	92.6	27.5	40.0	19.5	20.5	2.12	25 31	1.9	641	1,521	3.087	.670
100....	26 27	1.6	94.4	29.8	42.7	20.2	21.6	2.23	26 34	1.8	638	1,634		
200....	27 32	1.5	96.2	32.2	45.5	20.9	22.8	2.34	27 39	1.7	634	1,753		

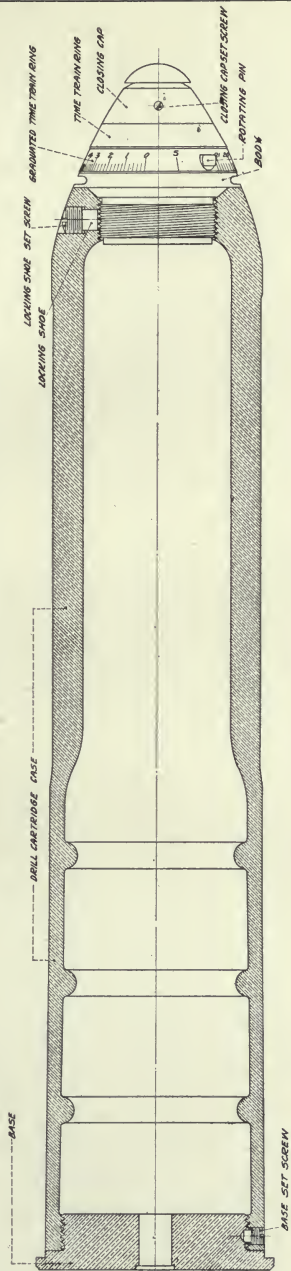
## SUBCALIBER CARTRIDGE.

[Plate VII.]

The subcaliber cartridge is used for subcaliber practice. It consists of a .30-caliber subcaliber barrel 17.75 inches long, mounted axially in a bronze subcaliber cartridge case, and resembles in weight and exterior dimensions the ammunition regularly used with the gun. The breech end of the subcaliber barrel is screwed into the base of the subcaliber cartridge, while the muzzle end is threaded to take the ogival-shaped head, which accurately fits the bore at the front end of the subcaliber cartridge case and is capable of longitudinal



2.95 IN. SUB-CALIBER CARTRIDGE.



2.95 IN. DRILL CARTRIDGE.





motion to allow for expansion of the barrel. Two flat steel extractor springs are each assembled to the base by an extractor-spring screw.

During subcaliber practice the extractor of the gun will be removed in order to prevent the breechblock from defacing the base of the subcaliber cartridge. The subcaliber cartridge is inserted and pushed home in the gun. The subcaliber cartridge, caliber .30, is then inserted in the chamber of the subcaliber barrel until its rim comes in contact with the extractor springs. The breech of the gun is closed, the face of the breechblock coming in contact with the subcaliber cartridge, caliber .30, shoves it to its seat, compressing the extractor springs. When the breech is opened the extractor springs throw the case of the subcaliber cartridge, caliber .30, far enough to the rear to permit its removal by the fingers.

The ammunition for United States magazine rifles of any model must not be used in subcaliber cartridges, the primers not being adapted for the blow of the firing pins of cannon. A special caliber .30 cartridge has been adopted for this purpose, and requisitions for subcaliber ammunition should call for "subcaliber cartridges, caliber .30."

As the residue from smokeless powder, if not completely removed, corrodes the bore in a short time, the subcaliber cartridges should be carefully cleaned after use. The bore should be cleaned with a rag saturated with soda water (one-half pound sal soda to 1 gallon boiling water) and wiped thoroughly dry with a clean rag. Then oil the bore with a light coating of light slushing oil or other suitable oil.

#### DRILL CARTRIDGE.

[Plate VII.]

The "drill cartridge" is a dummy cartridge for use in drilling cannoneers in the service of the gun. It is a bronze casting of the shape of the service shrapnel ammunition and is fitted at the point with a Frankford Arsenal 21-second combination fuze. Burned-out fuze parts that have been condemned or parts rejected by inspectors of the regular service fuze may be used. Time trains, percussion and concussion elements will be omitted. Fixed stop pin and rotating pin of new design will be used. This arrangement is for the instruction of cannoneers in fuze setting.

Drill cartridges in the service, provided with a dummy fuze similar to the 15-second combination fuze, will be fitted with movable graduated rings when the batteries are provided with shrapnel having the 21-second combination fuze.

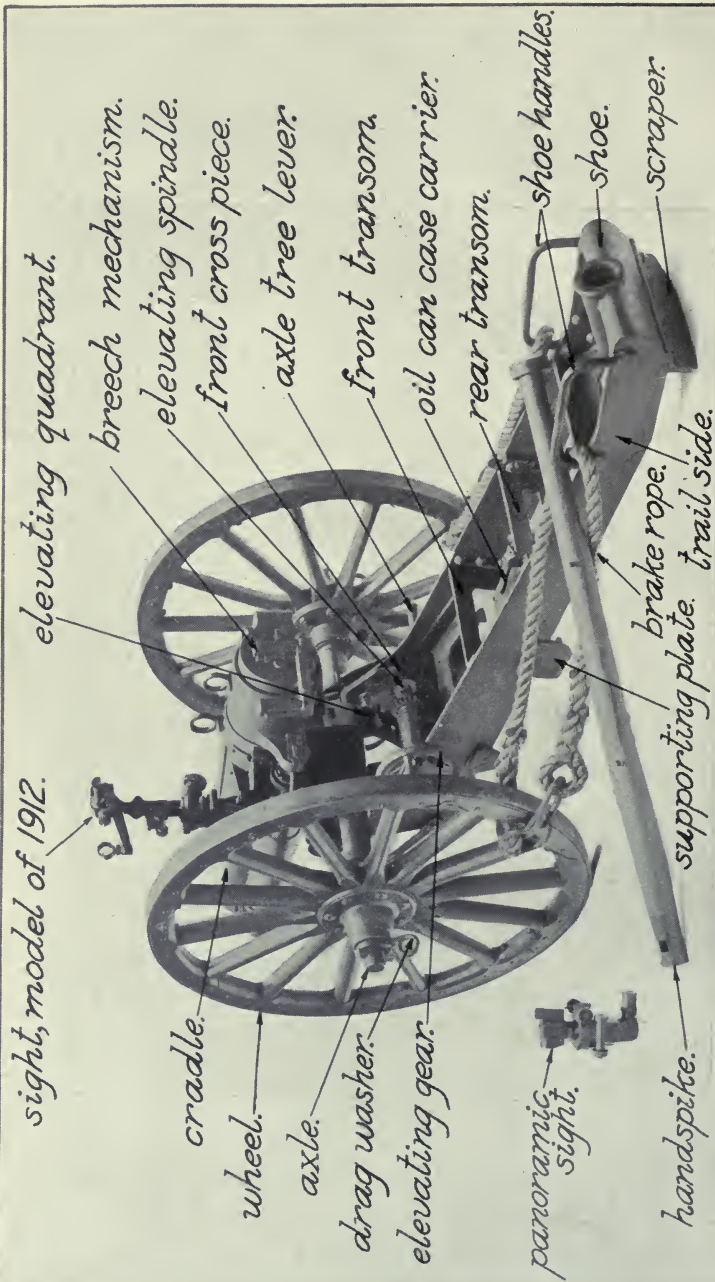
## SUBCALIBER AND DRILL CARTRIDGE KIT.

The subcaliber and drill cartridge kit consists of:

- |                              |                                    |
|------------------------------|------------------------------------|
| 3 drill cartridges.          | 1 locking shoe.                    |
| 1 subcaliber cartridge.      | 1 bristle cleaning brush.          |
| 2 extractor springs.         | 1 pin wrench.                      |
| 2 extractor-spring screws.   | 1 storage chest.                   |
| 1 cleaning rod.              | 3 rotating pins with locking pins. |
| 1 eyepiece.                  | 1 closing cap.                     |
| 1 extension piece.           | 1 closing-cap set screw.           |
| 1 graduated time-train ring. | 1 closing cap wrench.              |
| 1 time-train ring.           | 3 fixed stop pins with screws.     |
| 1 locking-shoe set screw.    |                                    |

One subcaliber and drill cartridge kit is issued for each gun.





2.95 In. Mountain Gun Carriage.



# Part I (b). THE 2.95-INCH MOUNTAIN-GUN CARRIAGE AND SIGHTS.

*Weights, principal dimensions, etc.*

Weight of carriage.....	pounds..	595
Weight of gun and carriage.....	do....	830
Diameter of wheels.....	inches..	36
Width of track.....	do.....	32
Length of recoil of gun on carriage.....	do....	14
Height of axis of gun.....	do....	26
Maximum angle of elevation.....	degrees..	27
Maximum angle of depression.....	do....	10
Amount of traverse of gun on carriage.....	do....	0

*Nomenclature of parts of the carriage.*

No.	Name of part.	Location, etc.	Class.	Section.
	Axletree, consists of—			
1	Axletree body.....			
1	Axletree lever.....	On axletree body.....		
1	Axletree-lever nut.....	Holds lever to axletree body.....		
1	Axletree-lever catch.....	In handle of axletree lever.....		
1	Axletree lever catch spring.....	do.....		
2	Linch pins.....	In ends of axletree.....		
2	Linch-pin springs.....	In linch pins.....		
1	0.062 ( $\frac{1}{16}$ ) by 0.362 pin.....	do.....		
2	Drag washers.....	On axletree, outside of wheels.....		
	Buffer, complete, consists of—			
2	Buffer springs.....	In cradle liners.....		
1	Piston rod, right.....	do.....		
1	Piston rod, left.....	do.....		
1	Piston-rod handle, right.....	On rear end of piston rod.....		
1	Piston-rod handle, left.....	do.....		
2	Piston-rod handle rivets.....	Connect handle to piston rod.....		
2	Piston heads.....	On front end of piston.....		
2	Piston screws.....	Locks heads to piston rod.....		
2	Buffer caps.....	On front end of buffer cylinder.....		
2	Buffer-cap packings.....	Behind buffer caps.....		
2	Glands.....	In rear end of buffer cylinder.....		
2	Cup-leather seatings.....	In front of glands.....		
2	Cup-leather packings.....	Between glands and seatings.....		
2	Cup rings.....	Secures packing to cup-leather seating.....		
2	Piston-rod packings.....	Between glands and cup rings.....		
4	Plugs.....	Closes filling and drain holes in cylinders.....		
2	Chains.....	Connect filling and drain plugs.....		
4	Filling plug packings.....	Under filling and drain plugs.....		
2	Loops.....	Secures plug chains to cradle.....		
2	Piston-lock screws.....	On rear of breechblock.....		
2	Piston locks.....	Hinged to lock screws.....		
2	Piston-lock rivet.....			
2	Piston-lock springs.....	On lock screw.....		
2	Piston-lock washers.....	do.....		
	Cradle, consists of—			
1	Cradle body.....	Holds gun and buffer details.....		
2	Cylinder liners.....	In buffer cylinders of cradle.....		
1	0.375 by 3.125 bolt.....	In left lug of cradle.....		
1	0.375 crown nut.....	On bolt.....		
2	Eyebolts.....	On top of cradle.....		
1	Instruction plate.....	Screwed to cradle.....		
4	Instruction-plate screws.....	Secures instruction plate to cradle.....		
2	Arrow plates.....	Soldered to cradle.....		
1	Sight bracket base.....	Riveted on cradle.....		
	Cradle axis bolt, consists of—			
1	Cradle axis bolt body.....	Secures cradle to trail.....		
1	Catch lever.....	In handle of cradle axis bolt.....		
1	Catch-lever spring.....	do.....		
1	Catch-lever split pin.....	Secures lever to cradle axis bolt.....		
1	Guard plate.....	On cradle axis bolt.....		
2	Guard-plate screws.....	Secures guard plate to cradle axis bolt.....		
1	Catch.....	On cradle axis bolt.....		
1	Shaft-locking screw.....	In right lug of cradle.....		
1	Washer.....	On cradle axis bolt left end.....		
1	0.187 ( $\frac{3}{16}$ ) by 2.25 split pin.....	In cradle axis bolt, left end.....		



## Nomenclature of parts of the carriage—Continued.

No.	Name of part.	Location, etc.	Class.	Section.
	Elevating mechanism, consists of—			
1	Elevating quadrant.....	Turns on axletree.....		
1	Guide arm.....	On elevating quadrant.....		
1	Guide-arm pin.....	Secures guide arm to quadrant.....		
1	Elevating spindle.....	Holds worm gear.....		
1	Elevating sleeve.....	On elevating spindle.....		
1	Elevating-sleeve key.....	Secures sleeve to spindle.....		
1	Elevating-worm spring.....	Against shoulder of sleeve.....		
1	Elevating-worm spring cup.....	Holds spring.....		
1	Elevating worm.....	On elevating sleeve.....		
1	Elevating-worm key.....	Secures worm to sleeve.....		
1	Elevating-sleeve nut.....	On end of elevating sleeve.....		
1	Elevating-sleeve split pin.....	Secures sleeve and nut to spindle.....		
1	Elevating bevel wheel.....	On rear end of spindle.....		
1	Elevating bevel-wheel key.....	Secures bevel wheel to spindle.....		
1	Elevating spindle nut.....	On rear end of spindle.....		
1	0.25 by 1.75 split pin.....	In rear end of spindle.....		
1	Support.....	Bearing for front end of spindle.....		
1	Elevating joint pin.....	Secures elevating quadrant to cradle.....		
1	Elevating joint-pin stop screw.....	Secures joint pin to quadrant.....		
1	Elevating pin.....	Shaft for handwheel.....		
1	0.203 by 1.25 split pins.....	In elevating pin.....		
1	Elevating pinion.....	On right end of elevating pin.....		
1	Elevating-pinion key.....	Secures pinion to pin.....		
	Elevating handwheel, consists of—			
1	Elevating-handwheel body.....	On left end of elevating pin.....		
1	Elevating-handwheel key.....	Secures handwheel to pin.....		
1	Elevating-handwheel handle.....	On handwheel.....		
1	Elevating-handwheel spindle.....	Secures handle to handwheel.....		
1	Elevating-handwheel washer.....	On spindle.....		
	Equalizing mechanism, consists of—			
1	Spring carrier.....	Near rack on elevating quadrant.....		
2	0.093 ( $\frac{3}{32}$ ) by 1 split pins.....	In spring carrier.....		
2	Equalizing springs.....	Between carrier and front crosspiece.....		
2	Equalizing-spring bushings.....	In rear end of springs.....		
2	Equalizing-spring eyebolts.....	Through holes in front crosspiece.....		
2	Equalizing-spring eyelets.....	Hold springs to carriers.....		
	Oil can case body, consists of—			
1	Billet.....	On body.....		
1	Body.....	Fastened to oil can case carrier.....	IV	2
1	Cap.....	On cover.....		
1	Cover.....	Fastened to body.....		
1	Cover chafe.....	On cover.....		
2	Filler.....	do.....		
	Trail, consists of—			
1	Trail side, right.....	.....		
1	Trail side, left.....	.....		
1	Front crosspiece.....	In front portion of trail.....		
1	Front transom.....	In middle of trail.....		
1	Rear transom.....	In rear of middle trail.....		
1	Shoe.....	In rear portion of trail.....		
1	Scraper.....	Rear under side of trail.....		
2	Shoe handles.....	Riveted to trail sides.....		
2	Handspike twisted dog chain.....	On top of shoe.....		
1	Handspike chain eyebolt.....	do.....		
1	Handspike chain hook.....	do.....		
2	Handspike ring.....	do.....		
1	Handspike key.....	do.....		
1	Oil-can case carrier.....	Between front and rear transoms.....		
4	0.625 wood screws No. 8.....	In oil can case carrier.....		
1	Oil can case body.....	Screwed on carrier.....		
1	Oil can case cover.....	Over oil-can case body.....		
2	Supporting plates.....	In middle of lower edge of trail sides.....		
1	Strengthening plate.....	Between trail sides before front transom.....		
1	Catch button.....	On right side of trail.....		
1	Stop button.....	do.....		
2	Distance plates.....	On bottom edges of trail near front.....		
1	Name plate.....	Screwed to front crosspiece.....		
2	Name-plate screws.....	Secures name plate to crosspiece.....		
2	Front handles.....	On front end of trail.....		
	Wheels, complete, consists of—			
2	Boxes.....	.....		
2	Flanges.....	.....		
14	Hub bolts with nuts.....	.....		
14	Felloe segments.....	.....		
28	Spokes.....	.....		
14	Clips.....	.....		
2	Tires.....	.....		
28	Tire bolts.....	.....		

## DESCRIPTION OF THE CARRIAGE.

## GENERAL.

The 2.95-inch mountain gun carriage is of the short recoil type, in which the gun is permitted a length of recoil upon the carriage sufficient to diminish the movement of the carriage on the ground, but not sufficient to render the carriage stable.

The gun is mounted in a cradle, which also forms a housing for the recoil-controlling parts. The cradle is fastened, by means of the cradle-axis bolt, to the trail and is also fastened to the elevating quadrant, which in turn is journaled to the axle, which passes through the trail.

The principal parts of the carriage are:

1. The cradle.
2. The buffer mechanism.
3. The cradle axis bolt.
4. The elevating mechanism.
5. The trail.
6. The axletree.
7. The wheels.

A detailed description of these parts follows.

## THE CRADLE.

The cradle is a bronze casting, comprising three parallel cylinders. The central cylinder supports the gun from the breech to within a few inches of the muzzle. Two smaller cylinders on the right and left sides of the central one accommodate the buffer. Each buffer cylinder is fitted with a bronze liner in which are cut three slots of varying width from rear to front, the purpose of the varying width being to maintain a constant pressure of the oil in the cylinder during the recoil of the gun. The buffer cylinders are connected by a passageway near the rear end, which equalizes the pressure in the cylinders. The forward ends of the cylinders are closed by the buffer caps, which screw in and compress a leather gasket (buffer-cap packing) to make an oil-tight joint. Near the buffer caps each cylinder is provided with a filling plug on top and a drain plug underneath; the plugs are chained to the cradle to prevent loss and are provided with leather gaskets (filling-plug packings). The central part of the cradle is extended to the rear underneath the breech of the gun and is provided with a bearing, which is locked to the rear end of the elevating quadrant by means of the elevating joint pin. In place of trunnions there are two lugs underneath the cradle, through which passes the cradle-axis bolt, by means of which the cradle is secured to the trail. Riveted to the rear end of the cylinder on the left-hand side is a sight-bracket base, in which is seated the sight bracket. An eyebolt for lifting the cradle to pack is screwed into bosses at each

end of this cylinder. A flat surface in a plane parallel to the axis of the bore of the gun is finished on top of the cradle, on which the gunner's quadrant may be placed. An instruction plate is screwed to the cradle on the right side of the flat surface for the quadrant. Two arrow plates are soldered to the right buffer cylinder, which indicate the positions for the cradle axis-bolt handle.

#### THE BUFFER MECHANISM.

The piston rods are of steel and threaded on both ends. The piston head is screwed on the front end of the rod and prevented from unscrewing by the piston screws. The rear ends of the rods are attached to the gun by interrupted screw threads and are engaged or disengaged by a quarter turn of the piston rod; a piston rod handle is riveted to each rod. Piston locks riveted to the gun lugs secure the piston rods when engaged with the gun lug threads. The piston heads fit the interior of the cylinder liners closely so that oil can not pass except through the liner orifices. After recoil the gun is returned to firing position by means of the two buffer springs surrounding the piston rods and located in the buffer cylinders. The rear end of each cylinder is closed by means of rings and gaskets to form oil-tight joints. The forward ring is a cup leather seating screwed to the cylinder; it has an annular recess on its rear face in which is seated a molded leather cup packing ring, so shaped that pressure of the oil in the cylinder forces a lip of the leather against the piston rod and prevents the escape of oil. A small bronze cup ring follows and between this cup ring and the gland, which is also screwed in the rear end, is compressed a piston rod packing of leather.

#### CRADLE AXIS BOLT.

The cradle axis bolt is a solid bar having a handle forged on one end in which is located a catch, consisting of a catch lever, catch lever spring, and catch, by means of which the cradle axis bolt is locked to the front crosspiece of the trail. A bolt in the left lug of the cradle engages a groove in the cradle axis bolt so as to prevent its longitudinal movement and a shaft locking screw in the right cradle lug projects into a slot cut partially around the bolt, thus limiting its rotary movement. The cradle axis bolt is so cut that in one position it engages in a seat provided for it in the trail, and 90 degrees from that position locks itself to the trail without preventing the cradle being elevated or depressed.

#### THE ELEVATING GEAR.

The elevating quadrant, by means of which the cradle is elevated or depressed, is made of cast steel having a worm wheel segment connected by means of an arm to the hub which engages the cradle axis



bolt. A yoke on the rear end of the segment engages a lug on the cradle, to which it is locked by means of the elevating joint pin. This pin is retained in the quadrant when disengaged from the cradle by the elevating joint pin stop screw located in one lug of the yoke. The hub which is the front fastening for the quadrant engages the cradle axis bolt and is cut away on one side to allow disengagement from the bolt when the latter is turned to its unlocked position. A guide arm which is pinned to the quadrant arm just below the hub is used to secure the quadrant to the front crosspiece of the trail when in pack. A spring carrier located on the quadrant arm near the rack teeth projects on both sides, each projection having a slot near its end which engages the eyelet of an equalizing spring extending back to the front crosspiece. The function of these springs is to maintain as near as possible a uniform weight on the elevating gear when it is being worked. Split pins hold the eyelet end of the springs on the carrier and the eyebolt ends on the rear face of the front crosspiece. The teeth on the quadrant engage a worm mounted on the elevating spindle. The latter is held on its front end by a support seated in the front crosspiece and near its rear end by a bearing in the rear web of the crosspiece. The worm which engages the quadrant teeth is keyed to a bronze sleeve which in turn is keyed to the spindle. Between the front shoulder of the sleeve and worm is located a rubber spring and cup, which allows a small longitudinal movement of the worm on the sleeve during firing. A nut is screwed on the rear end of the sleeve and secures the worm longitudinally; this nut is held in place by a large split pin, which also secures the sleeve on the spindle. The portion of the spindle in rear of its bearing in the front crosspiece is fitted with a bevel wheel keyed and held in place longitudinally by a nut and split pin. This wheel meshes with a pinion on the right end of the elevating pin which turns in a bearing on the left side of the front crosspiece. On the left end of the elevating pin is located the elevating wheel keyed to the pin and held by a split pin. A handle is located on the rim of the wheel by means of which it may be rotated.

#### THE TRAIL.

The trail is made of steel and consists of two side plates, connected at the front by the front crosspiece, at the rear by the shoe, and in the middle by the front and rear transoms and strengthening plate. The front crosspiece is a yoke or box of phosphor bronze, and contains bearings for the cradle axis bolt, axletree, elevating spindle support, elevating spindle, and elevating pin. The shoe at the rear end of the trail is also a phosphor-bronze casting, and is provided with a steel scraper or spade on the underside which checks the movement of the carriage on the ground; the shoe also carries a socket on its upper side in which can be fitted a handspike used for moving the carriage in

azimuth. Beside this socket is fastened a chain to which is attached a key for securing the handspike to the shoe. Two front handles and two shoe handles riveted to the trail sides are provided for lifting the trail to pack. To the front and rear transoms is riveted the oil can case carrier. On the lower edge of the trail sides are riveted the distance plates and supporting plates which form bearing points for the trail on the pack frame. The stop button and catch button fastened to the right side of the trail limit the movement of the axletree handle and secure it in the locked position. A name plate is screwed to the rear face of the front crosspiece. The name plate gives the serial number of the carriage, the model, name of manufacturer, year of completion, and initials of inspector.

#### THE AXLETREE.

The axletree is a solid cylindrical bar with flats cut on two sides so that it can enter its seat in the front crosspiece of the trail at a certain angle only, and when given a one-quarter turn is secure therein. Just outside the bearing for the right side of the trail the axle is fitted with an axletree lever having a spring catch on its handle which engages the projecting button on the trail side and locks the axletree in its proper relation to the trail. The axes of the tapering axle arms are inclined slightly to the axis of the axle so as to make the underside horizontal and the lower spokes of the wheel vertical. The wheel is secured to the axle by a linch pin passing through the axle arm. A heavy steel washer lies between it and the outer end of the wheel hub. The linch pin has a wire spring to retain it in the axle; the washer has a large eye or loop to which a dragrope may be attached.

#### THE WHEELS.

The wheels are 36 inches in diameter. Each has 14 hickory spokes and an ash felloe built up of seven segments, a bronze hub box which is connected through the spokes to a bronze flange on the outside by seven bolts, and a steel tire. The tire is  $1\frac{7}{8}$  inches wide and  $\frac{3}{8}$  inch thick. The felloe segments are joined by sheet-metal clips bolted through the felloe to the tire. The hub box has a taper fit on the axle.



## DISMOUNTING AND MOUNTING GUN AND CARRIAGE.

*To dismount the gun.*—Pull back the piston locks to clear the ends of the piston rods, and then turn the two piston-rod handles upward to a vertical position. The gun is now free and may be withdrawn by supporting the breech and pulling to the rear.

*To dismount the cradle.*—Elevate the cradle to extreme elevation and then depress until certain marks on the last thread of the worm come opposite the sides of the elevating quadrant. For new work and repairs a stop surface between the elevating quadrant and front cross piece automatically stops the quadrant at the proper elevation for disassembling. Press the catch in the handle of the cradle axis bolt, turn the handle to the rear  $90^{\circ}$ , or opposite the “unlocked” plate on the cradle; give the elevating joint pin one-quarter of a turn and draw it to the right, releasing the cradle from the elevating quadrant; the cradle is now free and may be lifted from the trail. The elevating wheel, should not be turned while the cradle is dismounted.

*To dismount wheels and axle.*—To detach the axle and wheels support the front of the trail by the two handles, press the axle lever catch in the handle of the axletree lever and turn the lever to a vertical position; the trail is then free and may be lowered to the ground. The wheels may be dismounted from the axle by removing the linchpins and drag washers.

*To mount the wheels and axle to the trail.*—Place the axle in the trail with the lever in a vertical position, and turn it until the catch in the lever becomes engaged with the catch button on the trail side; then lift the trail and put on the wheels, locking them on with the drag washers and linchpins.

*To mount the cradle.*—See that the elevating quadrant is in its correct position near extreme elevation with the assembling marks on the worm embracing the elevating quadrant. Drop the cradle axis bolt with its handle in the extreme rear position into the jaws or bearings provided for it in trail and elevating quadrant, then turn the cradle axis bolt handle forward until it is locked by the spring catch; lower the rear end of cradle until the lug on its underside lies in the yoke of the elevating quadrant and secure it with the elevating joint pin.

*To mount the gun.*—Lay the cradle horizontal, see that the bore for the gun is clean and that the piston-rod handles are vertical, place the front collar of the gun on the bridge at the rear end of the cradle and push the gun slowly forward until the guide button underneath the

barrel enters its groove in the bridge, push the gun home, turn the handles of the piston rods outward  $90^{\circ}$ , and engage the piston locks over the ends of the piston rods.

*To remove piston rods from buffer cylinders.*—If required to remove the pistons from the buffers, first dismount the gun as described, and provide a receptacle large enough to hold about 4 quarts of oil. Depress the cradle about  $5^{\circ}$ , unscrew the filling and drain plugs, and allow the oil to run out. Insert the spring-compression tool in the filling hole to retain the buffer spring, unscrew the buffer cap, and remove the leather washer; take out the set screw from the piston head, then unscrew and remove the piston head. Place the hollow end of the handspike against the front end of the buffer spring and compress this spring enough to withdraw the spring-compression tool, then remove the spring and withdraw the piston rod to the rear. It may be necessary to slack back the gland.

*To replace piston rods.*—Insert the piston rod from the rear, taking care that the packing and gland are in position; then enter the buffer spring from the front and compress it, using the hollow end of the handspike, so that the spring-compression tool when pushed down the filling hole will engage the last coil but one. Remove the handspike and screw on the piston head, securing it in position for the piston screw. The piston screw must be tight and secure, so that it will not work out and damage the cylinder. Replace the buffer-cap washer and buffer cap and screw the latter down hard. Replace the drain plug and withdraw the spring-compression tool.

*To fill the buffer cylinders.*—Give the cradle  $2^{\circ}$  or  $3^{\circ}$  of elevation and fill slowly through the filling-plug hole; when apparently full allow a few minutes for the oil to settle and pocketed air to escape, and then refill. See that the filling-plug gasket is in place and screw in the plug tightly. After a few rounds, especially if fired rapidly, the gun may remain slightly out of battery. This is due to the heating and expansion of the oil and may be remedied by bringing the gun to  $2^{\circ}$  or  $3^{\circ}$  of elevation, removing the filling plug and permitting the excess oil to run out.

About  $6\frac{1}{2}$  pints of oil are required to fill the buffer cylinder. Hydroline oil of a specific gravity of 0.85 is furnished by the Ordnance Department for use in these cylinders; it is characterized by its low freezing point and by its noncorrosive action on metals. The oil used in the cylinders should be clean and free from grit and dirt; to insure this it should be strained through a clean piece of linen or muslin before using. In emergencies during war water may be used in the cylinders. This should be done only when absolutely necessary, and never in freezing weather, and as soon as practicable the cylinder should be emptied, cleaned, and thoroughly dried and filled with hydroline oil.

## CARE AND CLEANING OF BUFFER CYLINDERS AND OTHER PARTS OF CARRIAGE.

The carriage is a machine for controlling the recoil of the gun and must be properly cleaned and cared for to insure its working correctly. The officers responsible for the efficiency of the battery should familiarize themselves with the carriage mechanism and with the foregoing instructions as to the method of mounting and dismounting the various parts, and should see that the carriage is properly handled, cleaned, and cared for. The following general directions for its care and cleaning are given:

The buffers should be dismantled and examined for roughness, broken or weakened buffer springs, etc., at least once every three or four months. If any scored or rusted spots are noticed they should be smoothed or cleaned by careful use of a dead-smooth file or fine emery cloth. Emery should be used with great caution and care should be taken that no emery is allowed to remain in the cylinders. Where unusual rubbing or scoring has occurred, the facts will be reported to the officer of the Ordnance Department, charged with the duty of keeping the battery in repair, for his information and action.

The parts should be reassembled immediately after cleaning and inspection and the cylinders filled with the hydroline oil issued for that purpose. The gun should be pulled from battery by hand and permitted to counterrecoil rapidly to insure that all parts are in proper position for firing. *This should never be done, however, unless the cylinder is known to be filled with oil.* In removing and inserting the piston rod care should be taken to keep it central in the cylinder, so as not to bind, burr, or spring any parts. The dismantling and reassembling of the parts of the cylinder should in every case be supervised by a commissioned officer. Before firing an inspection should be made to ascertain that the different parts are correctly assembled.

The recoil-cylinder oil should be stored in the closed cans provided for the purpose, and be carefully protected from dirt, sand, or water. Oil withdrawn from cylinders and containing any sediment must not be used again for any purpose until it has been allowed to settle for not less than 24 hours. When sediment has thus been permitted to settle, great care must be taken not to disturb it in removing the oil. To insure the cleanliness of all cylinder oil it should be strained through a clean piece of linen or muslin before using.

The elevating mechanism should be dismantled at least once every six months for thorough cleaning and overhauling. It should be kept well oiled and should work easily. If at any time the mechanism works harder than usual, it should be immediately overhauled and the cause discovered and removed.



The nuts on the hub bolts should be tightened monthly the first year of service and twice a year thereafter. The ends of the bolts should be lightly riveted over to prevent the nut from unscrewing.

The wooden parts of the wheels are made of thoroughly seasoned materials, and the hub bolts, when the wheels are issued, are properly tightened; but all wood is susceptible to change with atmospheric conditions, so that the spokes speedily become loose, and if the wheel is used in this condition it will rapidly be made unserviceable and may be damaged beyond repair.

*The importance of strict compliance with these instructions can not be overestimated.*

## SIGHTS.

The arrangement for sighting and laying the piece include a combined front and rear sight (open sight) and a panoramic sight, either of which may be mounted in a seat in the top end of the sight shank. The sight bracket which supports the sight shank is assembled to the sight-bracket base, riveted to the left side of the cradle.

### SIGHT MODEL OF 1912.

The upper end of the sight bracket is provided with bearings for the shank socket. This shank socket is pivoted on an axis parallel to the axis of bore, which, by means of a leveling screw and cross level, serves to correct for difference of level of wheels.

The shank-socket cover has two lugs on its inner surface which support springs and sleeves. These sleeves are pressed by the springs against the shank and force it against the walls of the shank socket, thus taking up lost motion.

Upon the left side of the sight shank is attached a level bracket, in which is mounted a level screw and an elevation-level holder, the construction allowing the movement of the level holder through the arc of a circle in the vertical plane parallel to that of the sight shank. The amount of angular movement of the level holder is measured by the level scale, graduated on the level holder with an index on the level bracket, supplemented by a level micrometer disk on the level screw. The level scale is graduated in sixty-fourths of the circumference, and one complete turn of the screw moves the level holder through one of these divisions. The level micrometer disk on the level screw has 100 divisions, so that one of these divisions corresponds to 1 mil ( $\frac{1}{1000}$  of the range). The divisions of the circular scale are marked 1 to 5 and, in connection with the level disk, are read 100, 200, etc., plus the indications of the latter. The 3 or 300 corresponds to the mean or zero position of the elevation-level holder.

This arrangement of graduated level serves the same purpose as the range quadrant on other carriages; it has the advantage that the sight and quadrant is combined in one instrument, thereby permitting the duties of laying for direction and elevation to be performed by one man.

The sight shank consists of a steel arc. It slides in guides in the shank socket and is moved up and down in elevation by a scroll gear seated in a boss on the shank socket and engaging in a rack cut on



the right side of the shank. A German silver range strip fits in a dove-tailed seat cut in the rear face of the sight shank, the index for the scale being placed upon the upper rear corner of the shank socket. The strip is graduated in yards for the 12½-pound projectile only up to 5,000 yards. The smallest division is 50 yards, but smaller divisions may readily be made with the eye.

The upper part of the sight shank is prolonged to form a support for the panoramic sight or the open sight. This support has a vertical T slot into which the guide lug of the panoramic sight or open sight fits. A clamp screw with a ratchet head is seated in the support and holds the panoramic sight or open sight in position by forcing it against the ways of the support. A small spring plunger detent seated in the sight shank bears against the ratchet head of the clamp screw and fixes it in position.

*The sight complete must be removed from the sight-bracket base before firing.*

#### OPEN SIGHT.

The peep sight and front sight are self-contained. The peep-sight support extends to the front and has a threaded seat to receive the front sight.

The front sight consists of two cross wires set at an angle of  $45^\circ$  to horizontal in the circular bore of the cross-wire holder and held in place by the cross-wire ring and the cross-wire retainer. The shank of the holder is threaded with 32 threads per inch, which allows it vertical movement in the holder sleeve. The outside of the holder sleeve is threaded with 30 threads per inch, which allows it a vertical movement in the sight support.

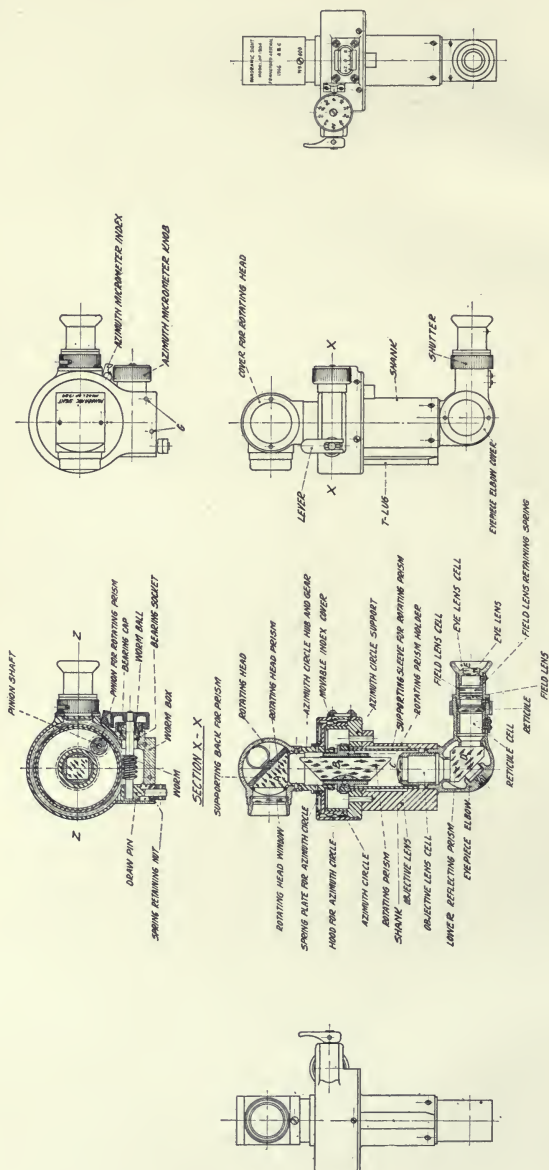
A  $\frac{1}{8}$ -inch split pin passes through the arm and through slots in the cross-wire holder and holder sleeve and fixes the cross-wire holder in a plane normal to the line of sight, the slots allowing vertical adjustment by the differential threads of the sleeve.

The rear end of the peep-sight support is fashioned to receive the peep-sight guide. The peep-sight guide is located in an opening in the peep-sight support and is perpendicular to the line of sight. The peep sight is secured by clips to this guide and is traversed along it by the peep-sight screw. The latter passes through a tapped hole in the peep sight and is supported at each end in bearings in the peep-sight support. The screw is turned by a knurled head at its left end. The peephole is 0.125 inch in diameter. The graduations on the deflection scale fixed to the rear end of the peep-sight support, together with the peep-sight screw handle, serve to give required deflections to the peep sight.

The deflection scale is attached to the rear face of the peep-sight guide and the index for the scale is on the peep sight. The graduations are in mils, or points equivalent to one one-thousandth part of



PLATE IX



PANORAMIC SIGHT MODEL OF 1904

the range. There are 50 mils upon each side of the zero, and the scale is marked from left to right as follows:

40	20	0	80	60
----	----	---	----	----

the actual mils being

40	20	0	6380	6360
----	----	---	------	------

thus making deflection readings on this sight uniform with those of the panoramic sight and the battery commander's telescope. The scale has a short longitudinal adjustment by which the zero of the scale may be located so as to bring the line of sight parallel to the plane containing the axis of gun.

#### PANORAMIC SIGHT, MODEL OF 1904.

[Pl. IX.]

The panoramic sight is a vertical telescope so fitted with reflecting prisms that the gunner with his eyes at the eyepiece, which is fixed in a horizontal position, may bring into the field of view an object situated at any point in a plane perpendicular to the axis of the telescope.

The details of the optical part of this instrument are shown in Plate IX, and comprise the rotating head prism A, the rotating prism B, the objective lens C, the lower reflecting prism D, and the eyepiece E. The rays coming from the object are reflected downward from the prism A into prism B, which rectifies them; after their passage through the objective lens C, the prism D reflects them in such a way that there is presented to the eyepiece E a rectified image, which the eyepiece magnifies. The prism B is of rectangular cross section. Its peculiarity is that on rotation about its longitudinal axis the image of an object seen through it turns with twice the angular velocity of the prism. As, therefore, the prisms A and B are so mounted as to rotate about this axis, prism B following A with one-half of the angular velocity of the latter, the image always remains as it would appear to one observing it directly with an ordinary terrestrial telescope.

The image formed by the objective lens would naturally be reversed and inverted. The lower inclined faces of the prism D by cross reflection transfer the rays to opposite sides of the axis, thus correcting the reversal. The correction of the inversion is accomplished by the combined action of the three prisms A, B, and D, the nature of the action varying with the different positions of the prisms. In the position shown on Plate IX, prisms A and D act as parallel reflectors, and they, without the lens system, would present an erect image. Prism B, however, inverts the rays and corrects



the inversion produced by the objective lens. It will be noted the effect would be the same whether the prism B occupies the position shown on the plate or be revolved  $180^\circ$  from that position. This latter position is the one it would assume if the prism A were rotated through  $360^\circ$ . If the prism A be now rotated through  $180^\circ$  the prisms A and D would form two reflectors set at right angles, and would give, without the lens system, an inverted image, and in conjunction with the lens system an erect image. Prism B in this case will occupy a position  $90^\circ$  from that shown on the plate, in which position it causes no inversion, but counteracts the inversion produced by prism D.

A glass reticule marked with crosslines is located in the focal plane of the instrument, with the intersection of the crosslines coincident with its optical axis. No provision is made for changing the focus of eyepiece or objective lens. As issued, the instrument is focused for the usual range and the average eye. The magnifying power of the instrument is four; the field of view is  $10^\circ$ .

The mechanical construction of the instrument is as follows: The body consists of a shank, provided on its front surface with a T lug which fits into a corresponding slot in the head of the sight shank and is held in that position on sights by a detent ratchet, and clamp screw. To the lower end of the shank is screwed the eyepiece elbow, forming a housing for the prism D and the eyepiece E. To the upper end of the shank is screwed the azimuth-circle support, to which is screwed the hood for the azimuth circle, forming a seat for the rotating mechanism of the sight. The opening in the rotating head is closed by the rotating-head glass window, which forms a dust guard. The rotating-head prism A is mounted opposite this opening. The lower end of the rotating head is seated in the azimuth-circle hub and gear. A worm located in worm box in the hood for azimuth circle engages in a worm gear cut on the azimuth circle.

The worm is pivoted at its rear end in the worm box by a ball-and-socket bearing. This bearing consists of the bearing-socket worm ball and bearing cap.

The worm-throw-out mechanism consists of the draw pin, draw-pin spring, spring-retaining nut, and lever.

The rotating prism B is secured in the upper end and the objective C in the lower end of the supporting sleeve for rotating prism resting in the hub and gear. The upper end of this supporting sleeve for the rotating prism and the lower end of the azimuth circle have gears which engage in a double pinion seated in the azimuth-circle support. The gears and pinions are calculated so that the angular velocity of the rotating head is twice that of the rotating prism B and is in the same direction. The motion of rotation is transmitted from the worm to the azimuth circle, thence to the azimuth-circle hub and gear, thence



to the pinion and through it to the supporting sleeve for rotating prism. The amount of motion of the rotating-head prism is indicated by a graduated scale on the perimeter of the azimuth circle, visible through the glass azimuth window in the rear face of the hood for the azimuth circle. The zero of the scale and the index on the head-piece are located so that the line of sight of the panoramic sight is parallel to that of the axis of the gun when set at 0 elevation and deflection.

The scale is formed by dividing the circumference into 64 equal parts. One complete turn of the worm moves the rotating-head prism through one of these divisions, or  $\frac{1}{64}$  of a circle. The rear end of the worm carries the azimuth micrometer knob with circumference graduated into 100 equal parts to form a micrometer scale. One of these subdivisions, therefore, equals  $\frac{1}{100}$  of a division of the main scale, or marks a movement of the rotating-head prism and line of sight through  $\frac{1}{6400}$  of a circle. An angular movement of the line of sight through  $\frac{1}{6400}$  of a circle corresponds very closely to a lateral displacement of  $\frac{1}{1000}$  of the range. Practically the subdivisions of the deflection scale on the panoramic sight are considered as points equal to  $\frac{1}{1000}$  of the range and are called milliemes or mils.

The reading of the deflection scale or the size of an angle is given in units of the micrometer scale as 2763, 1521, etc., meaning  $\frac{2763}{6400}$ ,  $\frac{1521}{6400}$ , etc., of 360°. The alternate divisions of the main scale are numbered in a clockwise direction 0, 2, 4, etc., to 62, inclusive. In reading the deflection scale, therefore, hundreds are read directly from the main scales and tens and units from the deflection-screw micrometer scale. At 0 the line of sight is parallel to the vertical plane through the axis of the gun; at 16 (or 1,600 mils) it is perpendicular to that plane and pointing directly to the right, etc.

The azimuth micrometer knob is secured on the rear end of the worm by a locking screw. This arrangement permits the 0 of the scale to be set opposite the index line on the azimuth micrometer index without movement of the worm in adjusting the sight.

The worm which is seated at its front end in the draw pin is held in contact with the worm gear on the azimuth circle by the draw-pin spring, and is arranged so that it may be disengaged from the worm gear by movement of a lever. When disengaged, the line of sight may be rapidly oriented to approximately the desired direction, the worm then thrown into gear, and finer adjustments made by turning the azimuth micrometer knob.

All panoramic sights have been made interchangeable, so as to fit in seats.

The following device for illumination of the cross lines of the reticule of panoramic sights is used.

A small slit is cut in the eyepiece elbow and the reticule cell on the side of the sight next the gun. A shutter is provided which encircles the eyepiece elbow opposite the slit, affording means for closing. On some sights this shutter is provided with a transparent celluloid window to prevent the entrance of dust. On the later sights a glass window is fitted in the side of the eyepiece. For illumination at night electric flash lights are used. They should be held close to the illuminating slot or window.

#### PANORAMIC SIGHT, MODEL OF 1915.

[Plate X.]

The panoramic sight is a vertical telescope so fitted with an optical system of reflecting prisms and lenses that the gunner with his eye at the fixed eyepiece in a horizontal position can bring into the field of view an object situated at any point in a plane perpendicular to the axis of the telescope.

The rays coming from the object are reflected downward from the rotating head prism into the rotating prism. The rotating prism rectifies the rays; after their passage through the achromatic objective lens, the lower reflecting prism reflects them in such a way that there is presented to the eyepiece a rectified image, which the eyepiece magnifies. The peculiarity of the rotating prism is that upon rotation about its longitudinal axis the image of the object seen through it turns with twice the angular velocity of the rotating prism. The rotating head prism and rotating prism are so mounted as to rotate about this axis; the rotating prism following the rotating head prism with one-half of the angular velocity of the latter, the image always remains as it would appear to one observing it directly with an ordinary telescope. The image formed by the achromatic objective lens would then be reversed and inverted. The rays are cross reflected to the opposite sides of the axis by the inclined faces of the lower reflecting prism, thus correcting the reversal.

The combined action of the rotating head prism, the rotating prism and lower reflecting prism and the nature of action varying with different positions of the prisms provide for the correction of the inversion of the image. The rotating head prism and lower reflecting prism, as shown in position on Plate X, act as parallel reflectors, and they, without the lens system, would present an erect image. The rotating prism, however, inverts the rays and corrects the inversion produced by the achromatic objective lens. It will be noted that the effect would be the same whether the rotating prism occupies the same position shown on the plate or be revolved  $180^\circ$  from that position. The rotating head prism must be turned through  $360^\circ$  to get a position of  $180^\circ$  for the rotating prism. If the rotating head







prism is rotated through  $180^\circ$ , the rotating prism and lower reflecting prism would form reflectors set at right angles, and would give, without the lens system, an inverted image, and in conjunction with the lens system an erect image. The rotating prism in this case will occupy a position  $90^\circ$  from that shown on the plate, in which position it causes no inversion but counteracts the inversion produced by the lower reflecting prism.

The instrument has a magnifying power of 4 and a field of view of  $10^\circ$ .

The principal parts of the panoramic sight are the rotating head mechanism, the elevation device, the azimuth mechanism, the rotating prism mechanism, the deflection mechanism, the shank, and the eyepiece.

The rotating head mechanism consists principally of the rotating head, rotating head prism, rotating head prism holder, prism-holder cover, elevation index support, prism shield, and rotating head cover.

The rotating head forms a housing for its movable parts, and provides seats for the elevation worm bushing and rotating head prism holder. The front opening of the rotating head is closed by the prism shield which forms a dust guard. The bottom threaded seat of the rotating head screws upon the upper end of the azimuth worm wheel and is locked in place by four azimuth scale retaining ring screws. Upon the rear face of the rotating head is engraved a scale which is used for measuring the elevation of the rotating head prism holder which retains the rotating head prism and has an index mark upon the projection which coincides with the graduations of the elevation worm micrometer head.

The rotating head prism is mounted within the rotating head prism holder between the prism support front, prism support bottom, and prism support back, and secured in position by the rotating head prism spring which bears upon the prism support back. The rotating head prism is protected on the right side by the prism-holder cover and on the left side by the elevation index support.

The prism shield is held within the rotating head by the prism shield retaining piece, which is in turn secured by two prism shield retaining piece screws.

The prism-holder cover screws into its threaded seat located in the right side of the rotating head prism holder and locked in position by the prism-holder cover screws.

The rotating head cover screws into its threaded seat located in the right side of the rotating head and held in place by the rotating head cover screws. The exterior of the rotating head cover has two small holes for test wrench, and engravings " $\text{Field } 10^\circ$ " and " $\text{Power } 4$ " are located on the exterior surface.

The elevation-index support screws into its threaded seat located in the left side of the rotating head prism holder and secured in place by the elevation-index support screw. The small holes in the exterior surface allows the use of teat wrench to enable the elevation-index support to be screwed in place. The support-retaining ring retains the elevation-index support with rotating head prism holder within the rotating head and is locked in position by the support-retaining ring screw.

The elevation index is held upon the elevation-index support by the two elevation-index retaining screws. The arrow, engraved upon the German-silver piece, which is dovetailed in the elevation index, coincides with the graduations of the scale engraved upon the rear face of the rotating head.

The elevation device consists principally of the elevation segment, elevation worm, elevation-worm bushing, elevation-worm retaining nut, and elevation-worm micrometer head.

The elevation segment is held in its seat, provided in the rotating head prism holder, by the segment lock pin. The movement of the elevation segment is limited between two dowel pins, which are driven through the rotating head.

The elevation worm is mounted eccentrically within the elevation-worm bushing, which when turned provides an adjustment to take up the wear between the worm threads and the worm teeth of the elevation segment.

The elevation-worm bushing has a screw-driver slot in its lower end, which is used for adjusting and is retained in position by the elevation-worm bushing clamp plug, which is secured by the bushing clamp plug screw.

The elevation-worm retaining nut retains the elevation-worm bushing and elevation worm lengthwise within the rotating head. The screw-driver slot, in the top of the elevation-worm retaining nut, is used for adjusting and is locked in position by the elevation-worm retaining nut screw.

The elevation-worm micrometer head is held upon the upper slotted end of the elevation worm by the locking screw. The scale, engraved upon the periphery, is graduated into 100 equal divisions, numbered every 10 divisions. The upper exterior diameter of the elevation-worm micrometer head is straight knurled to facilitate turning. One complete revolution of the elevation-worm micrometer head is equal to the distance between each graduation upon the scale on the rear face of the rotating head.

The open sight is constructed of bronze plate, bent to shape, having an arm projecting out at each end, each arm containing a hole. A bronze knee is soldered to the interior of the front project-

ing arm over the center of the hole in such a manner to form a sight which is used for quick sighting. The open sight is secured to the rotating head cover by two open-sight retaining screws.

The principle parts of the azimuth mechanism are the azimuth worm wheel, azimuth worm wheel support, azimuth worm wheel cover, azimuth worm, azimuth worm ball, throw-out cam, throw-out plunger, azimuth micrometer knob, and azimuth scale.

The azimuth scale is retained upon its bearings, provided on lower end of the rotating head, by the azimuth-scale retaining ring, which in turn is secured by four azimuth-scale retaining ring screws. The four elongated holes in the azimuth scale provide for adjusting. The scale, engraved upon the lower, exterior diameter, is graduated into 64 equal divisions, numbered every two divisions.

The azimuth worm wheel cover forms a housing for the movable parts of the azimuth mechanism and provides seats for the ball and socket bearing throw-out mechanism and deflection worm wheel and support ring. The arrow, engraved upon the upper exterior diameter of the azimuth worm wheel cover, coincides with the graduations of the azimuth scale. The scale engraved upon a boss on the rear face of the azimuth-worm wheel cover is used for measuring the deflection of the object. The arrow, engraved upon the offset on the rear right side of the azimuth worm wheel cover, coincides with the graduations on the azimuth micrometer knob.

The felt washer which is retained in its seat, is located in the upper end of the azimuth worm wheel cover, provides for sufficient friction between the rotating head and the azimuth worm wheel cover.

The azimuth worm wheel support spring tends to retain the azimuth worm wheel upon the azimuth-worm wheel support.

The gear teeth of the lower part of the azimuth worm wheel mesh with the rotating head pinion, which upon rotation moves the rotating head mechanism. The lower part of the azimuth worm wheel support screws into its threaded seat provided in the upper part of the shank.

The azimuth worm is provided at one end with an azimuth worm ball, held in place by a bearing cap and bearing socket. A clearance space is provided so that the bearing cap can be adjusted to take up wear. A throw-out plunger with a spring and spring retaining nut, is provided for compensating for wear between the azimuth worm and azimuth worm wheel. A throw-out lever which is pinned to a throw-out cam, which in turning acts on the throw-out plunger, is a means provided for disengaging the azimuth worm and azimuth worm wheel. The azimuth micrometer knob is held on the slotted end of the azimuth worm by the locking screw. The scale is divided into 100 equal divisions, numbered every 5 divisions. One complete



revolution of the azimuth micrometer knob is equal to the distance between each graduation on the azimuth scale.

The rotating prism mechanism consists principally of the rotating prism, rotating prism holder, rotating prism supporting sleeve, rotating prism pinion, and rotating prism block.

The rotating prism is of rectangular cross section, mounted and retained in position within the rotating prism holder by rotating prism block which is secured by the rotating prism set screw. The rotating prism holder is seated in the upper section of the rotating prism supporting sleeve. The rotating prism pinion is driven upon the pinion shaft. The rotating head pinion is driven upon the hub of the rotating prism pinion. The pinion shaft is mounted at both ends in its seat provided in the azimuth worm wheel support which upon rotation, moves the pinion shaft. This gear system is so designed that the rotating head moves twice the angular distance of the rotating prism holder.

The principal parts of the deflection mechanism are the deflection worm wheel and support ring, deflection worm, deflection worm bushing, deflection dial, and deflection worm knob.

The deflection worm wheel and support ring is seated within the azimuth worm wheel cover located by two dowel pins, and then retained by six deflection worm wheel and support ring screws. A segment, projecting downward into the shank, carries a worm wheel which meshes with the deflection worm. The deflection worm wheel support is located within the shank and against the deflection worm wheel and support ring by two dowel pins, and secured by two deflection worm wheel support screws.

The deflection worm is mounted eccentrically within the deflection worm bushing which when turned provides an adjustment to take up the wear between the worm threads and the worm teeth of the deflection worm wheel and support ring.

The deflection worm bushing is adjusted by using the fingers upon rear end and is restrained in position by the deflection worm bushing clamp plug, which is secured by the deflection worm bushing clamp-plug screw. A German silver piece is pinned and soldered to the rear end of the deflection worm bushing on which is engraved three arrows with letters "R" and "L." The middle or large arrow coincides with the graduations of the deflection dial. The compensating spring is provided for taking up all lost motion that appears lengthwise in the mechanism. The worm knob is secured to the deflection worm by a taper pin; the periphery being straight knurled to facilitate turning. The deflection dial is held on the front slotted end of the deflection worm by the locking screw. The scale engraved upon the front end is graduated into 100 equal divisions, numbered



every 10 divisions. The shank forms a body for the instrument and provides seats for the azimuth worm wheel support, deflection worm bushing and elbow. The front surface is provided with a T lug which fits into a corresponding slot in the upper end of the shank of the rear sight. Upon the rear surface is dovetailed the deflection index which is retained in place by the deflection index screw.

The arrow, engraved upon the deflection index, coincides with graduation on the rear face of the azimuth worm-wheel cover.

The eyepiece consists principally of the reticule, the reticule cell, achromatic field lens, achromatic eyelens, and eyelens cell.

The achromatic objective lens is mounted in the upper end of the objective lens cell. This cell is secured in its threaded seat in the upper end of the elbow by two objective lens cell retaining screws.

The elbow is secured in the lower end of the shank and secured by the four elbow retaining screws in such a manner that its projecting arm is horizontal to the axis of the instruments. The elbow provides seats for the lower reflecting prism and the eyelens cell. The lower reflecting prism is held upon its bearing surfaces, provided in the elbow by two wedges which in turn are secured by the two wedge screws. These screws are retained by the wedge screw lock screw. The wedge screw cover is provided to retain the wedge screw lock screws in position. The wedge screw cover is secured by the wedge cover screw. The opening of the elbow upon the right and left sides are closed by the elbow covers, which are locked by the elbow cover screws. Upon the left side of the elbow is an opening through which the light is thrown upon the reticule. This opening is covered by the window to protect the interior of the eyepiece from dust and dirt. The shutter is so designed to slide over the opening in the elbow being guided by the shutter stop screw and movement limited by the elongated slot.

The reticule has two crosslines etched on its surface and is mounted in the forward end to the reticule cell which is secured in the eyelens cell by the reticule cell retaining screw.

The achromatic eyelens is mounted in the eyelens cell and is separated from the achromatic field lens by the lens separator. The achromatic field lens is held within the eyelens cell by the field lens retaining ring, which in turn is locked by the field lens cell retaining ring screw. The eyelens cell is secured to the elbow by the eyelens cell retaining screw.

All interior metallic surfaces exposed to the refracted light are finished with dull black baking enamel. All exposed optical elements, covers, and nonrotating joints are sealed with the litharge cement or equal. All German silver graduated surfaces are sand-blasted and lacquered.

## USE OF THE OPEN SIGHT AND PANORAMIC SIGHT.

*For direct aiming.*—Set the rear sight at the required elevation; correct for difference of level of wheels; set off deflection ordered; elevate the gun and traverse the carriage until the crosslines of the peep sight are on the target.

## PANORAMIC SIGHTS, MODELS OF 1904 AND 1915.

*For direct aiming.*—Set the rear sight at the required elevation and correct for difference of level of wheels; set off the desired deflection on the azimuth circle of the panoramic sight; bring the crosslines of the sight upon the target by means of the elevating and traversing devices of the carriage.

*In using the model of 1915 sight for direct fire, care must be taken that the rotating head be set at 300 mils and the deflection mechanism at 0.*

*For indirect aiming.*—Set the sight shank at the required range and correct for difference of level of wheels. Set the azimuth scale of the panoramic sight at the deflection ordered. By means of the micrometer screw, set the movable level until the reading on it is equal to the angle of site ordered. By means of the elevating handwheel of the carriage and by traversing the carriage on the ground, manipulate until the bubble in the movable level is centered and until the vertical cross wire in the panoramic sight is on the aiming point.

*For measuring ranges.*—Distances or ranges may be roughly calculated from readings made by two panoramic sights mounted on their guns, as follows:

Direct the guns on the target; then sight the panoramic sights on each other. The angle at the target subtended by the line connecting the two guns is then 3,200 mils minus the sum of the actual angles in mils measured at the guns.

If B is the distance between the guns in yards, then range equals B multiplied by 1,000 divided by the number of mils in the angle at the target.

The accuracy of this method increases as B becomes smaller so long as the instruments can be read correctly.

## CARE OF SIGHTS.

Whenever convenient, and especially when in garrison and not in use, the front and rear sights and panoramic sights should be kept in some dry place, as in the barracks' storeroom or office.

When traveling the sight bracket with shank and sight complete is removed from the sight bracket base and placed in the sight case.

All parts of the shanks and shank sockets should be kept clean, free from rust, and lightly oiled. When stored or not used for short periods, they should be thoroughly cleaned and well coated with

light slushing oil. Should any part become rusted, it should be carefully cleaned by softening the rust with coal oil and rubbing with a soft-pine stick.

In handling all parts of the sights care must be exercised to avoid injuring them by dropping, striking them upon or with other parts, etc.

To clean the joint between the sight bracket and the shank socket, drive out the taper pin from the end of the leveling screw and remove the leveling screw. Disassemble the shank socket from the sight bracket, clean all parts, and oil them with sperm oil. Assemble in the reverse order.

Oil the leveling screw from time to time.

Extra glass level vials assembled in brass tubes, to replace broken vials in sights, will be issued on requisition.

Only ordinary tools, such as a hammer and a punch or a piece of wire, are required for the removal of pins from level caps in order to replace vials. All pins on level caps are driven in toward the center of the instrument. They should be driven out in the opposite direction. Four adjusting screws in the vial tubes are used for adjusting the tubes in their holders.

#### CARE OF THE PANORAMIC SIGHT, MODELS OF 1904 AND 1915.

These sights are delicate instruments and must not be subjected to any rough usage, jars, or strains. In firing they are removed from the carriage; in the field, when not in use, they are kept in the sight case.

To obtain satisfactory vision, the glasses must be perfectly clean and dry. The T lug on the sight and the slot forming its seat should be kept lightly oiled as a preventive of rust. The worm and worm rack should be oiled with vaseline. When dust accumulates on the pointers, it should be removed by a fine camel's-hair brush in the hands of an experienced person.

To disassemble the worm mechanism of the model of 1904 sight for cleaning, throw out the worm-box eccentric lever, disengaging the worm from the worm gear of the azimuth circle. Insert a pin in the radial hole in the spring-box pin. Throw the worm-box eccentric lever back and engage the worm in the azimuth circle. Push the spring box toward the worm knob about three-eighths inch and then lift it straight out. Take out the eccentric-lever stud and remove the worm-box eccentric lever. Pull out the dowel in the worm-box pin with a pair of pliers and drive out the worm-box pin. Then pull out the worm box and worm complete. The worm may be cleaned without further disassembling. Assemble in reverse order.

The teeth of the worm wheel may be cleaned without disassembling the hood.



To clean the rotating-head window and the front face of the rotating-head prism, unscrew the window cell in the rotating head. Do not remove the rotating-head window from the window cell.

To clean the reticule and eyepiece lenses, remove the screw holding the eyepiece to the eyepiece elbow and unscrew the eyepiece. To disassemble the lenses, remove the set screw on the under side of the eyepiece and unscrew the eye-lens cell. The field lens is held in place by a retaining spring, both of which may drop out as soon as the eye-lens cell is disassembled.

In assembling note that the flat surface of the field lens of the eyepiece is placed next to the reticule. Do not remove or change the adjustment of the reticule. Its rear surface may be cleaned with a camel's-hair brush after the eyepiece has been removed.

*In panoramic sights of serial numbers after No. 752, the exposed optical elements and all nonmoving joints are sealed, and no attempt should be made to remove them.*

For serial numbers 873 and up, the slight change in the appearance and construction of the elbow and rotating head is made for the purpose of making these parts dust and moisture proof.

#### ADJUSTMENT OF SIGHTS.

The sights are correctly adjusted when at zero elevation and deflection the line of sight is parallel to the axis of bore.

The movable level is correctly adjusted when with the sight shank set at zero, level scale at 300, the axis of the gun horizontal, and, when corrected for difference of wheel, the bubble of the movable level stands in the center of its vial. In adjusting sights, the panoramic sight should be corrected first.

To adjust the rear (open sight) proceed as follows:

With the sight shank set at zero, the direction of the line of sight is changed by means of the peep-sight screw and by altering the front sight until it is parallel to the axis of the bore. The method of determining when this condition exists is given below. The deflection scale on the peep-sight support is then shifted and the micrometer head on the peep-sight screw moved until everything reads zero. The movement of the deflection scale is provided for by elongated holes in the deflection scale through which pass the screws which clamp it in position to the peep-sight support. Movement of the front sight is accomplished by turning the holder sleeve after first removing the split pin.

To adjust the movable level: With the bore of the piece horizontal and the sight set at zero elevation, the position of the level holder is changed by the level screw until the bubble is in the center of its vial. The nut inside the level handle which clamps the graduated disk is then released and the disk rotated until zero comes opposite its index.



## TO ADJUST THE PANORAMIC SIGHT, MODEL OF 1915.

Should backlash or lost motion appear lengthwise in the elevation device, it can be removed by loosening the elevation-worm retaining-nut screw, setting up on the elevation-worm retaining nut and then tightening up on the elevation-worm retaining-nut screw. To remove backlash between the threads of the elevation worm and worm teeth of the elevation segment, loosen the bushing clamp plug screw which releases the elevation-worm bushing clamp plug, and then turning the elevation bushing, in which the elevation worm is eccentrically mounted, so as to bring the elevation worm closer in contact with the worm teeth of the elevation segment. The elevation-worm adjusting clamp plug must be firmly clamped after adjusting by tightening up on the bushing clamp plug screw to secure the elevation-worm bushing against rotation. After adjusting, should the zero upon the elevation-worm micrometer head not coincide with its index when the elevation index coincides with the graduations of the scale upon the rear face of the rotating head, it can be easily remedied by loosening the locking screw and turning the elevation-worm micrometer head until the zero just coincides with its index, after which it must be firmly secured by tightening the locking screw.

Backlash which may occur between the threads of the azimuth worm and the worm teeth of the azimuth worm wheel is taken up automatically by the spring that forces the throw-out plunger which seats the azimuth at its left end in toward the azimuth worm wheel. The four elongated holes in the azimuth scale afford means for adjusting when its zero does not coincide with the arrow head upon the upper exterior diameter of the azimuth worm-wheel cover when the zero of the deflection scale, upon the rear of the azimuth worm-wheel cover, coincides with arrow head upon the deflection index. After this adjustment is made the azimuth micrometer knob should be inspected similar to that elevation-worm micrometer head.

Backlash that appears between the threads of the deflection worm and the worm teeth of the deflection worm wheel and support ring can readily be removed when the method of adjusting similar to that of the elevation device is followed out.

## TO ADJUST THE PANORAMIC SIGHT, MODEL OF 1904.

Direct the panoramic sight by means of the azimuth micrometer knob and rear sight scroll gear until its line of sight is parallel to the axis of the bore. The method of determining when this condition of parallelism exists is described hereafter. Without disturbing the direction of this line of sight move the azimuth micrometer knob of panoramic sight and the range strip of the rear sight until the zero

marks come opposite their respective indices. The azimuth micrometer knob may be moved after loosening the locking screw in the end of the worm. This locking screw may be loosened by the combined teat wrench and screw driver issued for the purpose. If the azimuth micrometer knob can not be readily removed, grasp the sight by the azimuth micrometer knob, release the worm from the worm gear of the azimuth circle, and gently tap the exposed end of the worm with a small piece of wood or soft metal.

To locate the index opposite the zero of the scale loosen the four screws that hold the movable index cover in place and move this cover until the index is properly located; then tighten the screws. Movement of the range strip of the rear sight is made possible by a slot in the shank in which the range strip screw can be moved when the nut has been loosened.

#### VERIFICATION OF PARALLELISM OF LINES OF SIGHT AND AXIS OF BORE.

The adjustment of the sights is of such importance and should be verified so frequently that battery commanders will find it advantageous to make permanent arrangements for such verification. The leveled supports constituting the carriage emplacement should preferably be of stone. The site of the target (fig. 1) should be prepared and the exact locations of the target and horizontal reference points permanently marked. If these arrangements are properly made, subsequent verifications of sights will become a simple matter.

A target of dimensions given in figure 1 is placed in a vertical position perpendicular to the line of sight, at such a height that the point "bore" is at the same height as the axis of the bore of the gun. The verticality of the target is assured by a plumb line attached at A, coinciding with the vertical line AB.

The carriage is placed with the wheels and trail resting upon solid supports of wood or stone, the surfaces of which have been carefully leveled so as to bring the axle axis horizontal. Now direct the gun so that the prolongation of the axis of the bore, as determined by the bore sights, pierces the target at the proper point; the lines of sight of the open and panoramic sights are then adjusted in direction by the means explained above until they pierce the targets in the points marked, respectively, "open" and "panoramic."

The axis of the bore is determined and prolonged by means of bore sights. In the absence of such means, a breech-bore sight may be made from an empty cartridge case from which the primer has been removed; a piece of paper should be pasted over the primer seat and a pinhole made in its exact center to serve as a peep sight. If the cartridge case does not completely fill the bore, it should be shimmed all around with tissue paper until it does so. For a muzzle-bore

sight, use should be made of the traces of the horizontal and vertical planes containing the axis of the bore, which are marked on the muzzle of the gun. Fine threads or hairs stretched across the muzzle to coincide with these lines form a good bore sight, and the ends of such threads may be conveniently fastened to a cloth strap buckled around the muzzle of the gun.

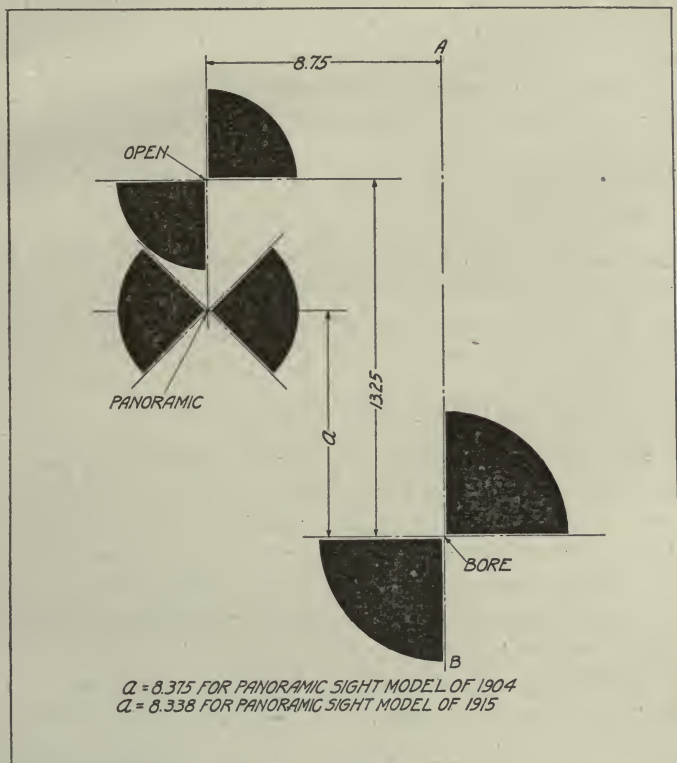


FIGURE 1

In the field, where from lack of time or proper facilities the method just given can not be followed, the adjustment of the sights may be verified by bringing the lines of sight at zero elevation and deflection to bear upon some sharply defined point of a distant object. At such a range (for instance, 2,000 yards or more) the parallax may be neglected, and if the sights are correctly adjusted the lines of sight and the prolongation of the axis of the bore will sensibly pass through the selected aiming point.

#### ADDITIONAL TESTS.

After the sights are adjusted they should be subjected to the following tests to insure their accuracy at extremes of elevation and azimuth:



(a) With carriage level and gun and sights at zero elevation and deflection, the lines of sight and axis of bore prolonged pierce the target (fig. 1) in the proper points.

(b) The gun is then moved to its maximum elevation; as the sight elevation is altered, the lines of sight should follow the vertical lines through the same points of the target (fig. 1).

By construction and assemblage the sights, if correctly adjusted, should fulfill the above conditions with substantial accuracy. If error be noted, a report of the facts in the case with the cause, if known, should be made to the ordnance officer charged with the repair of the material for his information and action.

#### GENERAL INSTRUCTIONS FOR CARE AND PRESERVATION.

Keep all optical surfaces clean.

For the cleaning of optical surfaces use only the materials supplied by the Ordnance Department for that purpose.

Do not use on optical surfaces any cleaning material which is dirty or covered with oil or dust.

#### ADJUSTING INSTRUMENTS.

A complete detailed description of the method of disassembling and adjusting the different instruments is given in Ordnance Office Pamphlet No. 1795, Instructions for the Care, Preservation, Repair, and Adjustment of Instruments for the Fire-Control Systems for Coast and Field Artillery. Attention is invited to General Orders No. 47, War Department, March 24, 1905, with reference to the care and repair of panoramic sights.

No disassembling of instruments except as prescribed herein will be permitted. The disassembling of telescopic instruments allowed herein must be done only in the presence of a commissioned officer. Disassembling as permitted in Pamphlet 1795 must be done only by officers or employees of the Ordnance Department.



## Part I (c).—TOOLS AND ACCESSORIES FOR THE GUN AND CARRIAGE.

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The tools and accessories for the gun and carriage are listed on page 91.

A description of some of these articles follows.

### BRAKE ROPES.

Each brake rope consists of a 1-inch rope with a hook at one end and a ring at the other. Each rope is passed through the shoe handle and between the lower spokes of the wheel on both sides of the carriage. The hook is brought from the inside of the wheel between the spokes and engaged in the ring, after which the rope is tightened by turning the wheel downward to the rear. With the wheels thus locked, the friction on the ground diminishes the movement of the carriage on the ground.

### BUFFER-SPRING CASE.

The buffer-spring case is a cylindrical pouch of leather with a flap cover. A single loop of leather or strap keeper is riveted on the case, through which is passed the strap by which the case is bound to the pack.

### CRADLE TOMPIONS.

The cradle tompions are sheet-metal bodies covered with flannel for closing the central bore of the cradle when the gun is dismounted. One front tompion and one rear tompion with the connecting sections of strap constitute a set.

### GUNNER'S POUCH.

The gunner's pouch is a leather case for the lanyard, originally designed for attaching to the waist belt of the gunner but now generally fastened to the rear transom of the trail.

### THE GUNNER'S QUADRANT.

The gunner's quadrant consists of a frame and the index arm which swings in the frame. This frame has graduated scales ranging from 0 to 65° on both sides of its arc and a toothed rack on the underside of the arc. Two frame shoes are screwed to the underside of the frame

to facilitate placing it on the cradle. The index arm is fastened to a lug on the frame which allows it to swing along the rack on the arc of the frame. The index arm head engages this rack and is held against it by the index arm head spring, located in the index arm. Index arm head guides, containing the index marks, are screwed to both sides of the head. The sliding level is located on the index arm, which is graduated from 0 to 60 minutes. The level may be fastened tightly to the index arm by the sliding level spring and screw. On the end of the index arm is located the sliding level stop. The gunner's quadrant is used to test the level of the sights.

#### GUNNER'S QUADRANT POUCH.

The gunner's quadrant pouch is a leather case for the gunner's quadrant.

#### HANDSPIKE.

The handspike is a hardwood staff with a slotted bronze ferrule on one end, which fits the socket in the shoe; it may be locked to the shoe by means of the handspike key; a cup-shaped bronze head on the other end is used for compressing the buffer springs. The two pins in the body form stops to prevent slipping when the handspike is used as a lifting bar.

#### SIGHT CASE.

The sight case is a cylindrical leather case reinforced with steel and has a hinged cover. The case is arranged to receive the panoramic sight, shank with level-holder bracket and socket, and peep sight complete. The sight case is carried in the gun seat in the cradle when the cradle is being carried in pack.

#### TOOL POCKETS.

The two pouches of leather are distinguished by their interior arrangement as "tool pocket with inside pockets" and "tool pocket with inside straps" containing the material listed on page 91.

#### TUBULAR OIL CAN.

Eight cans of brass, approximately 3 inches in diameter by 15 inches long, are provided for carrying a supply of oil.

#### TUBULAR OIL-CAN CARRIER.

For carrying the tubular oil cans a tubular oil-can carrier is provided, consisting of two pouches of leather provided with straps by which the cans are secured and attached to the pack. The pouches are right and left.

## Part II (a). THE PACK HARNESS.

The group of parts of the pack outfit used for leading the animal and carrying the load with its special holders is called the "pack harness." It consists of the blinder, halter bridle, corona, saddle blanket, aparejo, sobrejalma, crupper, and aparejo cincha.

These parts are common to all aparejo outfits and may be used without special frames for packing bundles and boxes.

### BLINDER MODEL OF 1916.

A pack mule is ordinarily blinded during harnessing and unharnessing, loading and unloading. The blinder consists of an inner and outer piece of russet harness leather stitched together around the outer edges and joined in the rear by leather thongs, the whole shaped to fit closely around the animal's eyes.

### HALTER BRIDLE, MODEL OF 1910.

This article is designed to furnish a light, strong head harness for a mule. When leading the animal, on the march, the bit and its straps are removed from the headstall and fastened to any convenient place on the pack frame. The two snaps of the lead rein are then fastened to the floating ring, the body of the rein forming a loop convenient for holding in the hand.

In riding an animal the lead rein is used in combination with the bit, headstall, and bit straps as a bridle.

When a mule is picketed to a line the lead rein serves as a halter strap.

The bit is made of nickel steel to prevent rusting.

### CORONA, MODEL OF 1915.

The corona is the first piece of harness placed on the mule's back. It is a saddle pad made of four thicknesses of good quality gray flannel blanket, protected from sweat by a lining of cotton duck. The corona is made in three sizes and each size is stenciled on the under side to correspond with the size of the aparejo it is intended to accompany. The width is 26 inches for all sizes. In placing the corona it is laid well forward on the mule's back, canvas side down, and then slid to the rear until its front edge is just behind the point of the withers, care being taken that the hair lies smooth beneath it.

When manufactured in quantity, 10 per cent are 58-inch, 15 per cent 60-inch, and 75 per cent 62-inch.



## THE SADDLE BLANKET.

The saddle blanket forms additional padding under the aparejo. It is carried under the aparejo and over the corona.

The blanket is made of pure wool of olive-drab shade, with an olive-brown border of two stripes. The blankets are rectangular, 72 by 84 inches. Each blanket has the letters "U. S." and the bursting shell located in the center.

## APAREJO, MODEL OF 1911.

This article consists of an aparejo body and one aparejo frame. The aparejo body is made of two rectangular pieces of leather (back and belly pieces) sewed together along the edges and through the middle, forming two pouches. The edges, the middle seams, and particularly the ends are reinforced with heavy leather facings. Handholes for stuffing are left in the belly pieces, and holes and slits laced with thongs are made in the back pieces, so that the frame, or parts of it, may be inserted, removed, or replaced. The carrier pieces and front facings have lacing holes for the attachment and adjustment of the crupper. Two steel chock staples attach the sobrejalma and pack frame to the aparejo.

The rib sticks are furnished longer than necessary and should be sawed off to the proper length after the boot and top sticks are firmly rammed home. The first three sticks (starting at the front) are of uniform thickness; the remainder are tapered to give the rear of the aparejo more flexibility than the front. The sticks are stamped and are intended to be arranged in a gradually diminishing thickness.

Cloth is tacked to the top stick to prevent the hay from slipping down.

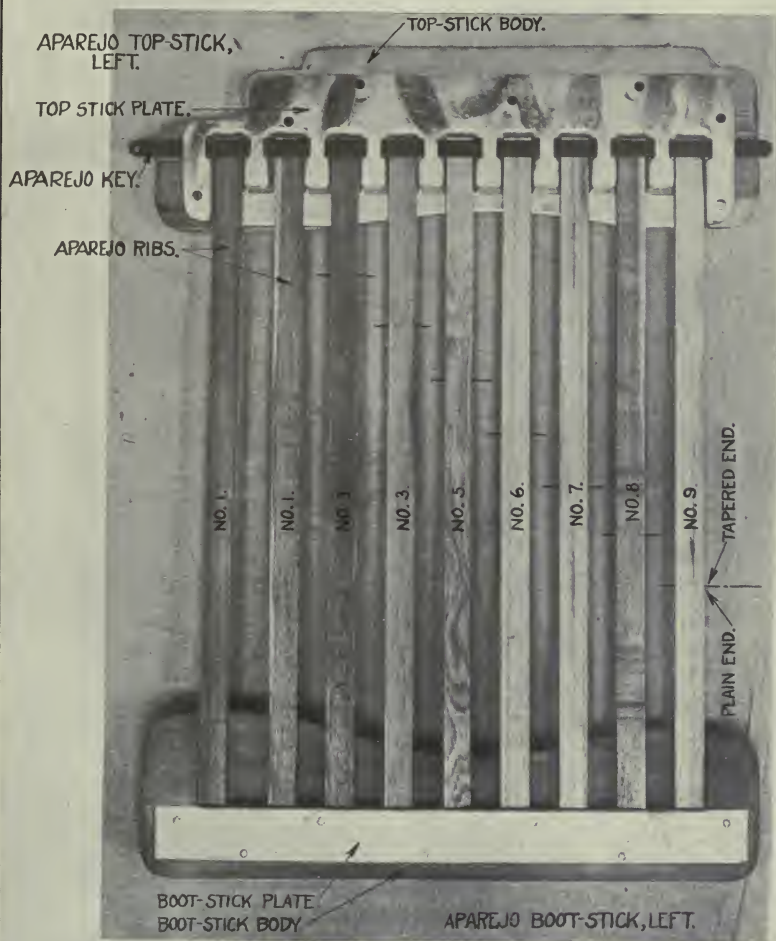
NOTE.—Aparejos are issued to the service with ribs in place. They are furnished in 58, 60, and 62 inch sizes. When issued upon requisition, the sizes are furnished as requested.

When issued without requisition, the sizes are furnished as follows: 15 per cent 58-inch, 50 per cent 60-inch, and 35 per cent 62-inch.

## SOBREJALMA, MODEL OF 1910.

This article is a waterproof and wear-reducing covering for the aparejo. It is made of one thickness of heavy cotton duck, faced around the edges on the upper side with collar leather. Two leather reinforces are placed on the upper side to protect the duck from the wear of the load. Holes are provided through which the chock-staples of the aparejo protrude; chock straps passing through these chock-staples hold the sobrejalma and pack-frame on the aparejo. All sobrejalmas are 25 inches wide.





Aparejo, Model of 1911; Frame.  
Left Half.



When manufactured in quantity 10 per cent are 58-inch, 15 per cent are 60-inch, and 75 per cent are 62-inch.

#### CRUPPER, MODEL OF 1912.

The crupper is made of russet collar leather, shaped (and padded in the middle) to fit the animal. The sidepieces extend forward, across the aparejo, and are laced to it in front and held up at rear by latigo-leather thongs. The depth of the sidepieces affords a broad surface to bear against the animal and also prevents the crupper from sagging. The sidepieces are reinforced with leather, and those portions which come in contact with the animal's flanks are lined with duck. Cruppers are made in one size only, 78 inches long.

#### APAREJO CINCHA, MODEL OF 1910.

The aparejo cincha is 10 inches wide and is made of cotton duck, folded and stitched along the middle. Both ends are faced with leather, and the end to which the cincha strap is fastened carries a five-sixteenths-inch steel rod in the fold of the lacing-end piece, while the other end has a curved piece of gas pipe (cincha bar). Fifteen inches from the strap end of the cincha, a leather throng (finger loop) is attached, which is used to carry the slack of the cincha strap. The cincha strap is of harness leather and has a rendering ring at one end; this end is attached to the cincha body by a latigo-leather thong. The metal parts are either of bronze or are copper plated to prevent rotting of the leather. The cincha is made in three sizes and when manufactured in quantity 10 per cent of 68-inch, 15 per cent of 70-inch, and 75 per cent of 72-inch. The size stamped on the cincha is the size of the aparejo for which it is designed. The cincha body is 10 inches longer than the corresponding aparejo.

#### INSTRUCTIONS FOR SETTING UP THE APAREJO.

*To rib up.*—Unlace the slits and handholes; soak the aparejo in tepid water for about 15 minutes; drain it and lay flat, back pieces up; insert the boot stick and the top stick through the slit in rear and press them to their places at the boot and the center-stitch line, slotted sides up; insert the numbered set of nine ribs through the slit in rear in their numerical order and seat them in that order from collar to rear in the slots of the boot stick and top stick, butts at the boot; secure the top of each rib as it is seated by inserting the aparejo key at the front edge below the collar and passing it over the rib in place; fasten the key bar to the collar by the thong.

NOTE.—The aparejo after being set up should under no circumstances be allowed to dry in the sun.

*To fill or pad.*—Turn the aparejo over, belly pieces up; procure about 6 pounds of long, fine, soft, elastic hay; taking a little at a time, tease or “mix” it carefully; insert it through the handhole and thus gradually fill the body of the aparejo with a smooth and even layer, not more than 2 inches thick.

NOTE.—Other filling may be used in necessity, such as moss, excelsior, curled hair, or sea grass; but these substitutes are difficult of manipulation in alterations necessary to accommodate the rigging to injuries of the mule. By teasing or “mixing” is meant the arrangement of the stalks of the hay so that they will cross one another. The body of the aparejo is that part which comes in contact with the body of the mule. As 3 inches of the lower portion of each boot stick and 3 inches of the upper portion of each top stick *must not* come into contact with the mule, no filling should be pressed under the boot stick or within 3 inches of the center of the stitch line. The body course tapers, however, so as to overlap the boot stick and saddle bar, and also tapers toward front and rear.

*To face or dress.*—To adjust the aparejo more accurately to the shape of the mule, introduce filling and press it well into the corner of the front boot; working toward the handhole, continue the facing along the boot stick and front edge, gradually increasing its thickness to about 1 inch at 7 inches from the corner and forming its inner edge into the arc of a circle concentric with the handhole, the thickness tapering to the ends of the arc; continue this for 3 inches more toward the handhole, rapidly decreasing the thickness to nothing. Proceed in exactly the same way at the collar; under no circumstances should the collar facing reach within 7 inches of the center of the handhole. Connect the front boot and collar facings by a dressing along the front edge about 3 inches wide and 1 inch thick, decreasing in thickness toward the handhole and toward the middle of the edge.

NOTE.—In facing up, introduce the filling with the palm of the hand up, so as not to disturb the body course. In case the leather will not yield enough to permit the filling to be introduced well into the corners, a tamping stick may be used to raise it. This stick, used with the commercial aparejo, is 4 or 5 feet long,  $1\frac{1}{4}$  inches in diameter, wedge-shaped for 4 inches from one end, the edge of the wedge being about  $\frac{1}{4}$  inch thick and grooved. The object of the boot facing is to cause the boot stick to carry horizontally and parallel to the center of the mule and to give free action to the mule's elbow. Mules of large barrel will require a thicker facing than described. The object of the collar facing is to cause the saddle bar to carry horizontally and parallel with the center of the mule and to protect the mule's withers. Mules with high withers will require a thicker facing than that described. In setting to the shape of the mule, the aparejo bends at the middle of the front edge. It is important that the body



course remain undisturbed during dressing, and that the instructions given be carefully followed to avoid sore withers or tails and body or belly bunches.

*To attach the crupper.*—Stand the aparejo on its boots in its normal position; secure a lace thong to the front hole on the upper facing of the crupper on each side and fasten the crupper with short thongs to the center holes of the carrier pieces on the rear of the aparejo; pass the crupper lace thong through the second hole from the top of the front facing of the aparejo, through the second hole of the crupper, through the third hole of the aparejo facing, through the fourth hole of the crupper, and so on, finishing through the bottom holes of the facing and crupper and tying to the crupper hole.

NOTE.—In lacing the crupper to the aparejo, the thong must be passed through the holes from the outside and must not be twisted, the lacing must not cross, and it is important that the tie be made on the last hole of the crupper instead of the aparejo.

Guayaba, willow, dogwood, hickory, or any other wood combining the qualities of permanent elasticity and strength may be used to replace broken ribs. When the set-up aparejo is to be filled, no soaking is necessary; instead, the belly pieces are made pliable by rubbing with a sponge.

Mules weighing 850 to 900 pounds require a 58-inch aparejo; 1,000 pounds, 60-inch; 1,100 pounds, 62-inch; and for heavier mules requisition should be made for larger sizes.

When the mule is loaded, the cincha, in travel, should free the elbow by about 1 inch; more than this will prevent a proper grip on the belly.

If the boots ride high enough on the body of the mule, or if they reach under the belly, even though they ride horizontally and parallel to the center of the mule, the aparejo will be likely to turn easily. This fault encourages injuriously tight cinching.

If one or both boots flare out or turn in toward the mule, cinch sores, sore tails, or belly bunches are caused.

The width of the collar-arch clearance should be at least  $5\frac{1}{2}$  inches. If it is too narrow or too wide, or if the saddle bars slope downward toward the front, there will be sores on the withers; if they slope to the rear, there will be injuries over the loins called "kidney sores."

If the lacing of the crupper is drawn too tight at the bottom, the lower edge of the crupper will rub the buttocks and cause abrasions.

The object to be attained is the uniform distribution of the weight of a load over that portion of the mule's body which is anatomically suited to the carrying of a burden, so that the saddle will ride with little motion and without friction of the bearing surface on the body. The contact of the bearing surface of the saddle must be close at all points. As the mule's body swells from front to rear, the more or less cylindrically shaped aparejo, after the body course is laid, must be

modified by facing up so as to provide a concave surface to fit over the convex surface. But, as the barrel of the properly conformed mule is nearly cylindrical through the rear half or more of the contact surface, no facing, as a rule, is necessary in the rear part of the aparejo, although confirmation may require it occasionally. The above instructions were prescribed by H. W. Daly, chief packmaster, Quartermaster's Department.

#### CARE OF RUSSET LEATHER.

Leather equipments which have become wet should be dried in the shade. Wet leather exposed to the direct rays of the sun or to the heat of a stove or radiator becomes hard and brittle.

When russet-leather equipments become soiled in service they should be cleaned by carefully washing the leather with a sponge moistened with a heavy lather made of clean water and Castile or Frank Miller's soap, and then rubbing vigorously with a dry cloth until the leather is completely dry.

If the leather becomes harsh, dry, and brittle from exposure to water or other causes, clean as above described, and while the leather is still slightly moist apply an exceedingly light coat of neat's-foot oil by rubbing with a soft cloth moistened (not *saturated*) with the oil. If it is found that too much oil has been used, the surplus can be readily removed by rubbing with a sponge moistened with naphtha or gasoline. But these oils are not issued for this purpose.

Where a polish is desired, the leather should first be thoroughly cleaned and then the leather polish or dressing supplied by the Ordnance Department should be applied sparingly and thoroughly rubbed in with a soft, dry cloth. Scars, cuts, or abrasions of the leather may be improved in appearance but not obliterated by similar use of the leather polish.

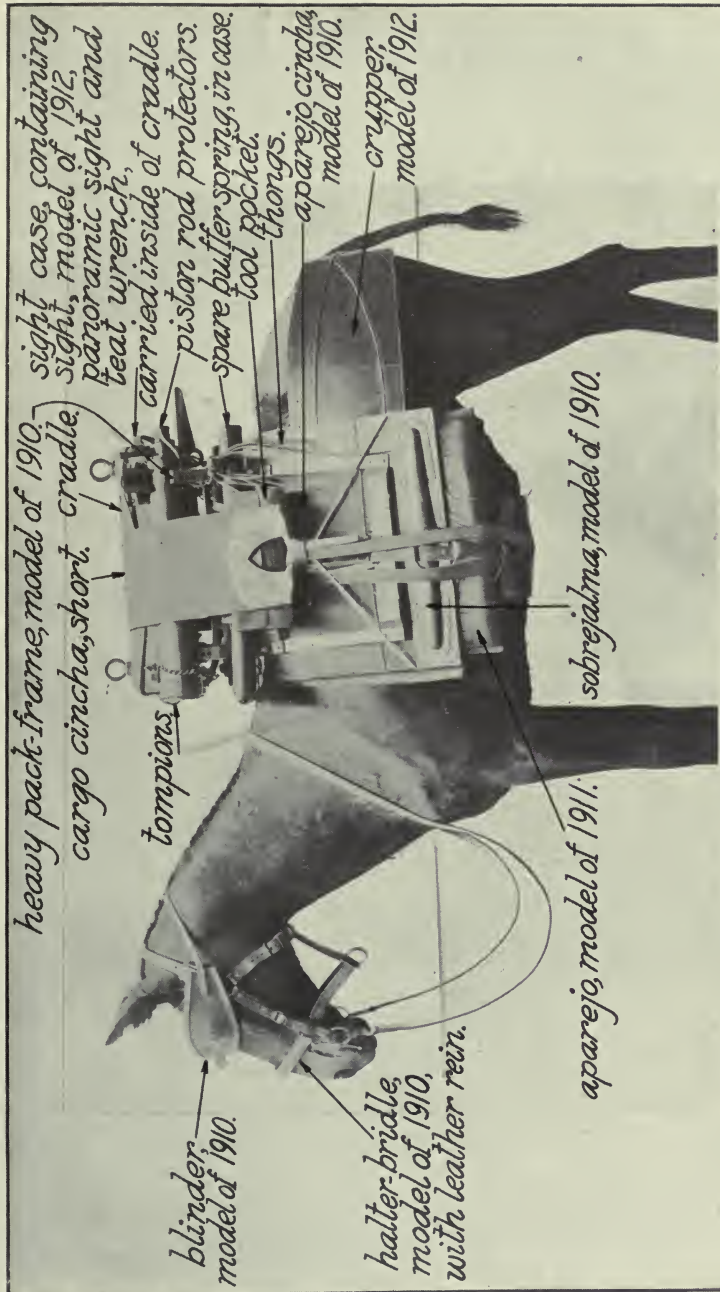
Russet leather may be cleaned, oiled, and polished as described above, but it should be noted that if more than a light coat of oil be given the leather will be greatly darkened and will quickly soil the clothing. No method of cleaning will restore the original light color of the leather or remove stains or discolorations.

#### CARE OF BLACK LEATHER.

To clean and dress black leather, wash it in water (lukewarm preferred) with Castile soap. An old horse brush will be found very satisfactory for applying the soap and water. Dry in the shade; when almost dry, apply the blacking, rubbing it in thoroughly.

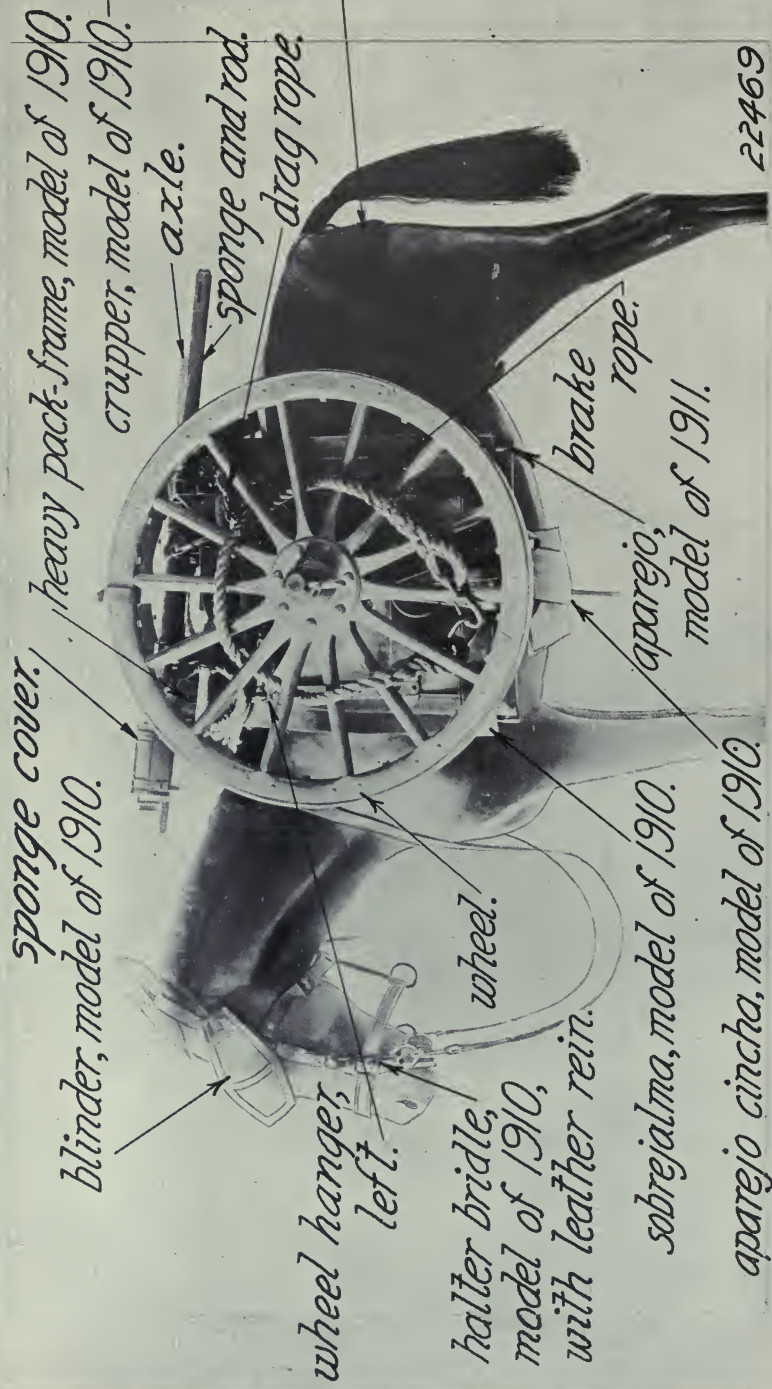
Dry in the shade and then apply neat's-foot oil with a sponge or rag, rubbing it well until the leather is soft and pliable.

When dry, a certain amount of oil and blacking will exude from the leather; this should be rubbed off with a dry cloth.



*Cradle Mule.*





*Wheels Mule.*



## Part II (b).—SPECIAL PACK EQUIPMENT.

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Axletree lever securing strap.	Sling rope.
Axle rest.	Thongs.
Cargo cincha:	Trail pads.
Long.	Wheel hangers:
Short.	Left.
Fastening straps (for rods, etc.).	Right, with cincha.
Lash ropes.	Wheel tie straps.
Load straps for canvas sacks for spare sticks.	Ammunition chests:
Pack covers.	12.5-pound projectile.
Pack frames:	18-pound projectile.
Model of 1912.	
Heavy.	

Plates XII to XXI, inclusive, show some of the special pack equipments with their loads attached, placed on the packs. A description of the articles in the equipment follows:

### THE HEAVY PACK FRAME.

The heavy pack frame consists of a metal body to which are hinged two pack-frame sides. The body consists of a pommel and a cantle riveted to two connecting bronze tie braces. Lugs projecting forward from the pommel and to the rear from the cantle have slots which drop over the chock staples of the aparejo. Four hook hinges, on the lower ends of which are cast heavy hooks for engaging side loads, are riveted to the upper parts of the pack-frame sides and secure the sides to the body. A pack-frame side has two vertical braces of spring steel which hang downward and are connected near their upper and lower ends by steel side bars upon which are riveted side-bar boards.

### PACK FRAME, MODEL OF 1912.

This pack frame consists of steel arches to which are hinged two pack-frame sides. Lugs projecting forward on the front arch and to the rear on the rear arch have slots which drop over the chock staples of the aparejo. Four hook hinges, on the lower ends of which are cast heavy hooks for engaging side loads, are riveted to the upper parts of the sides and secure them to the arches by means of pins and split pins. A pack-frame side has two vertical braces of spring steel which hang downward and are connected near their upper and lower ends by steel side bars upon which are riveted side-bar boards. Eight steel

strap-loop clevises with four straps are fastened to the arches by the pins securing the sides to the arches and furnish means of lashing articles to the pack frame.

#### WHEEL HANGER.

These hangers are designed to enable the wheels to be easily and quickly packed on the pack frame.

The eyes of the yoke fit over the hooks on the pack frame. A cincha, permanently fastened to the right hanger, holds the load down.

No linchpin is provided with the hanger, it being intended that the linchpin from the carriage should be used to hold the wheels in place.

#### WHEEL-TIE STRAP.

This strap is used for strapping the wheels together. It may be left on the wheel in action if the carriage is not to be moved any great distance.

#### AXLE REST.

This article is used as a seat for the axle on the pommel of the pack frame.

#### FASTENING STRAPS.

These straps, 1 inch wide and 47 inches long, are provided to fasten the sponges, rods, etc., to the frame on the wheel mule.

The loop on the bottom of the strap is designed so that the strap may be held to the frame when the rods, etc., are removed.

#### TRAIL PAD.

This pad, of russet bag leather stuffed with curled hair, is designed to be tied to the bottom of the trail for protecting the mule.

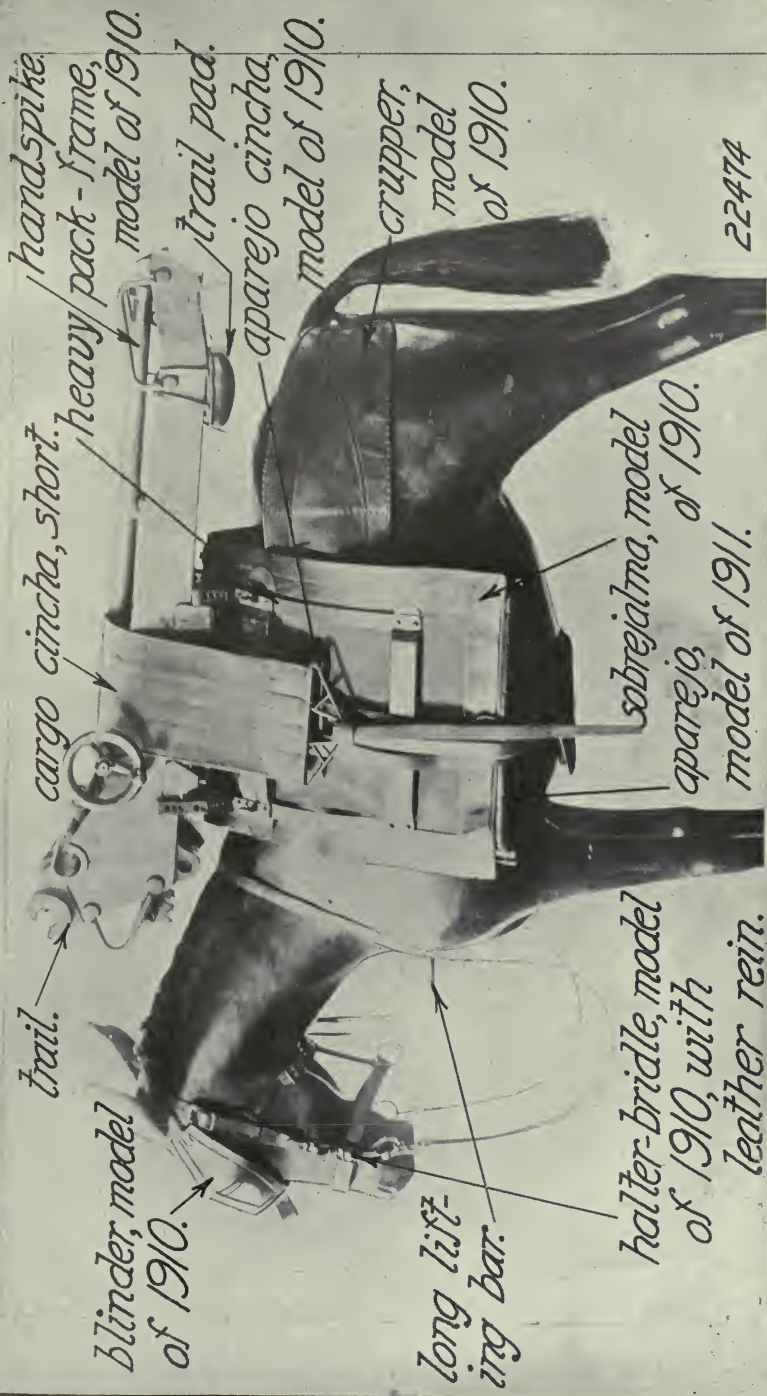
#### CARGO CINCHA SHORT.

This cincha consists of a double thickness of cotton duck with a russet-collar leather facing strengthened at the ends with a leather end piece in which is secured the cincha bars. A cincha strap is fastened at one end to a cincha bar. This strap is used to go entirely around the pack animal, binding the load tightly. It is used for the gun, cradle, and trail packs.

#### CARGO CINCHA, LONG.

This article is similar to the cargo cincha, short, the difference being in the length.

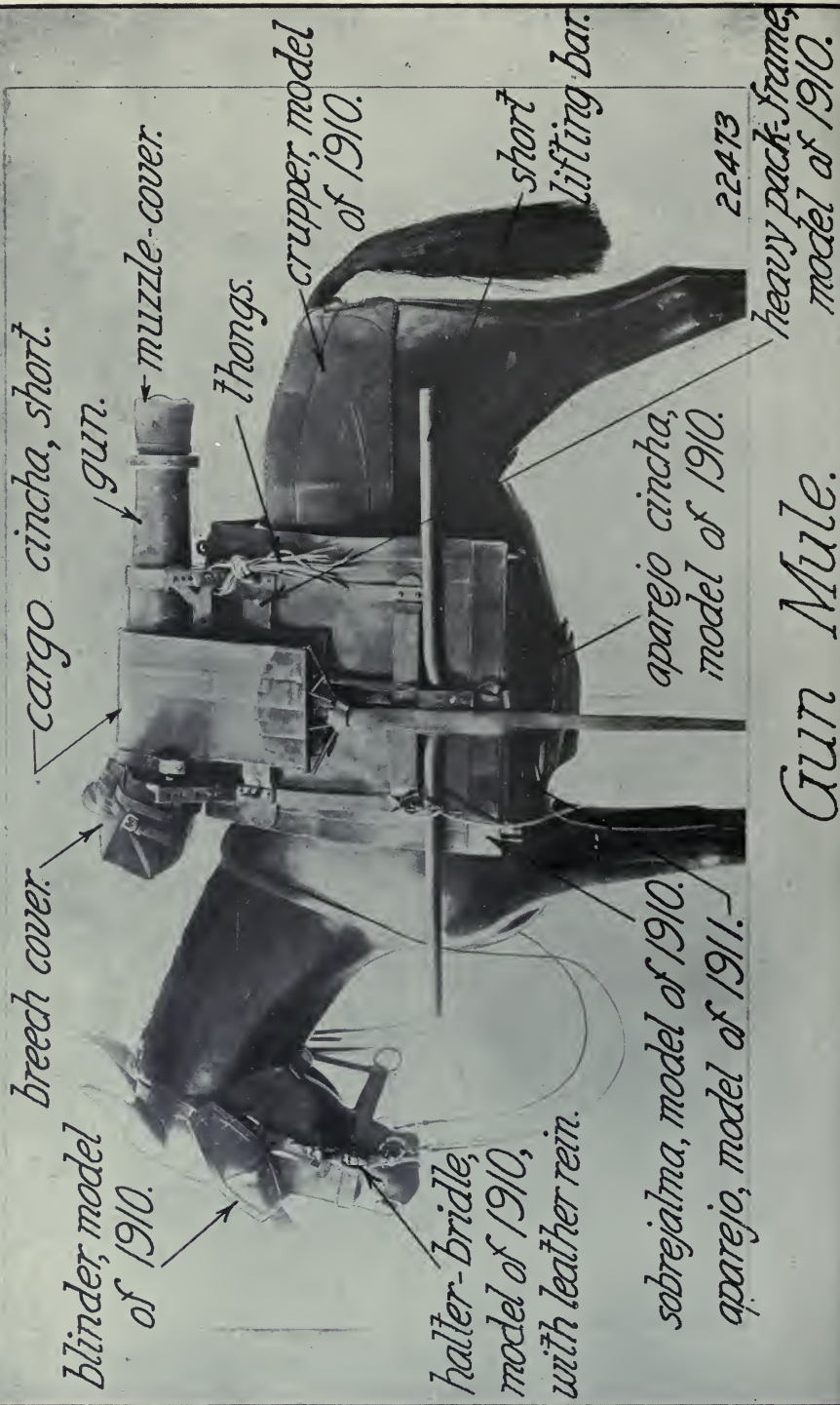
It is used for the ammunition packs.



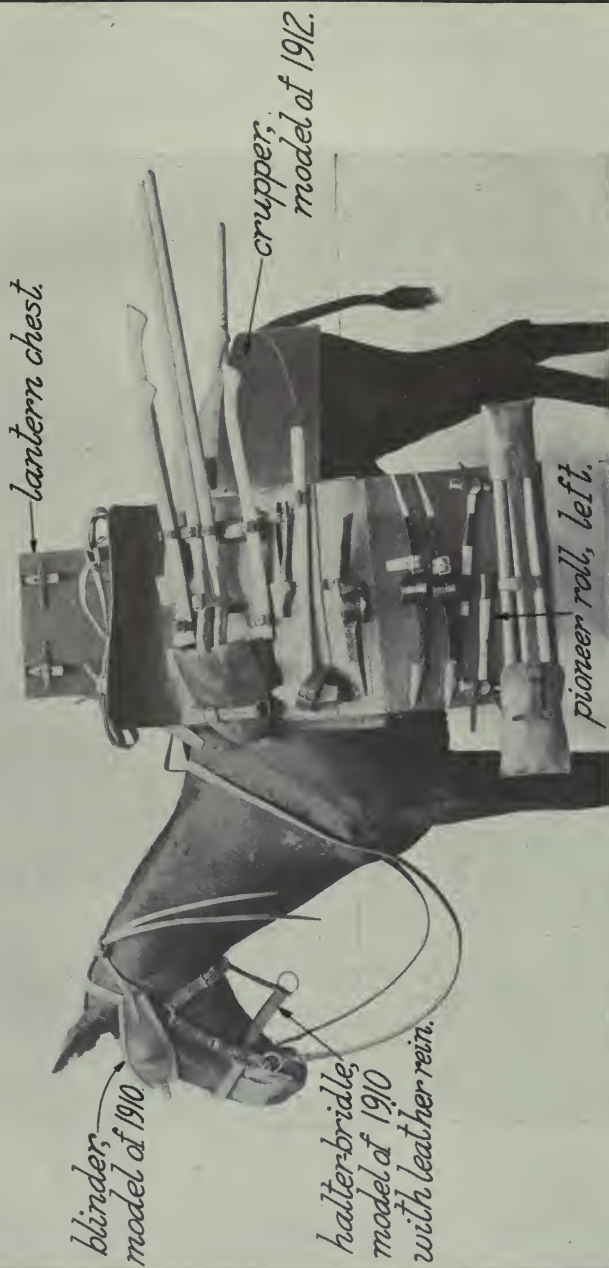
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Trail Mule.

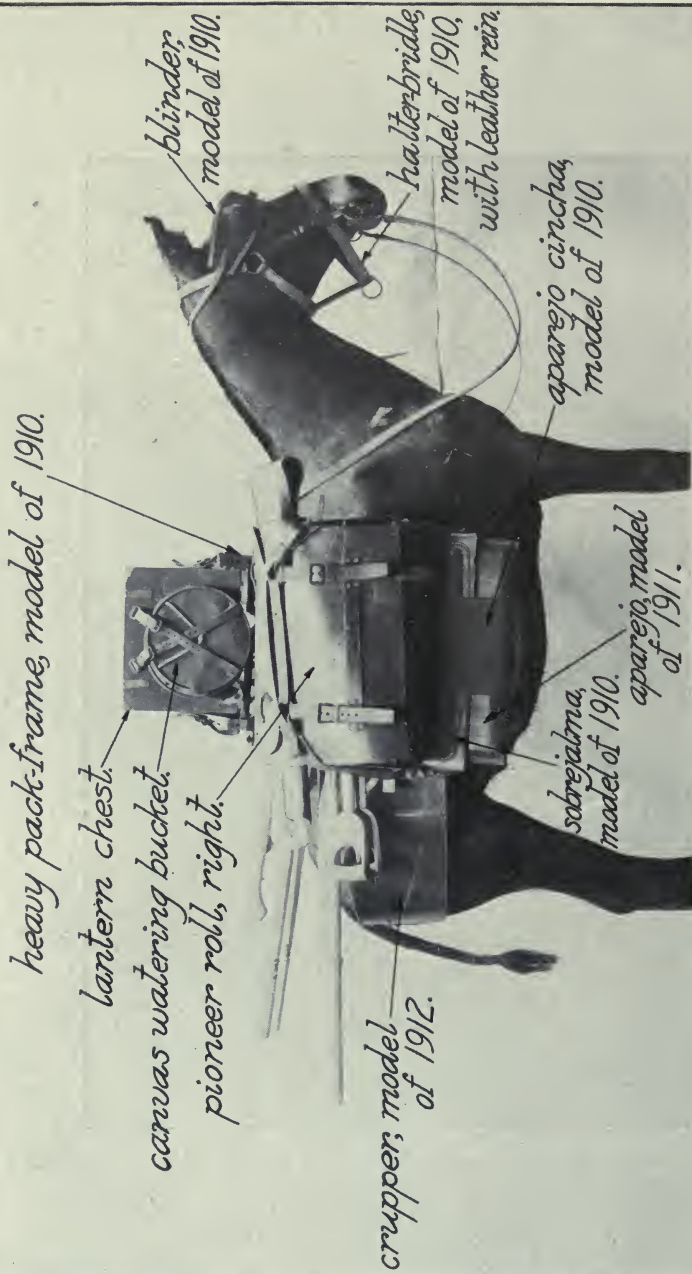








*Pioneer Tools. (Roll open).*



*Pioneer Tools. (Roll closed).*

*blinder, model of 1910.*

*reconnaissance chest,  
model of 1910.*

*sobrejalma, model of 1910.*

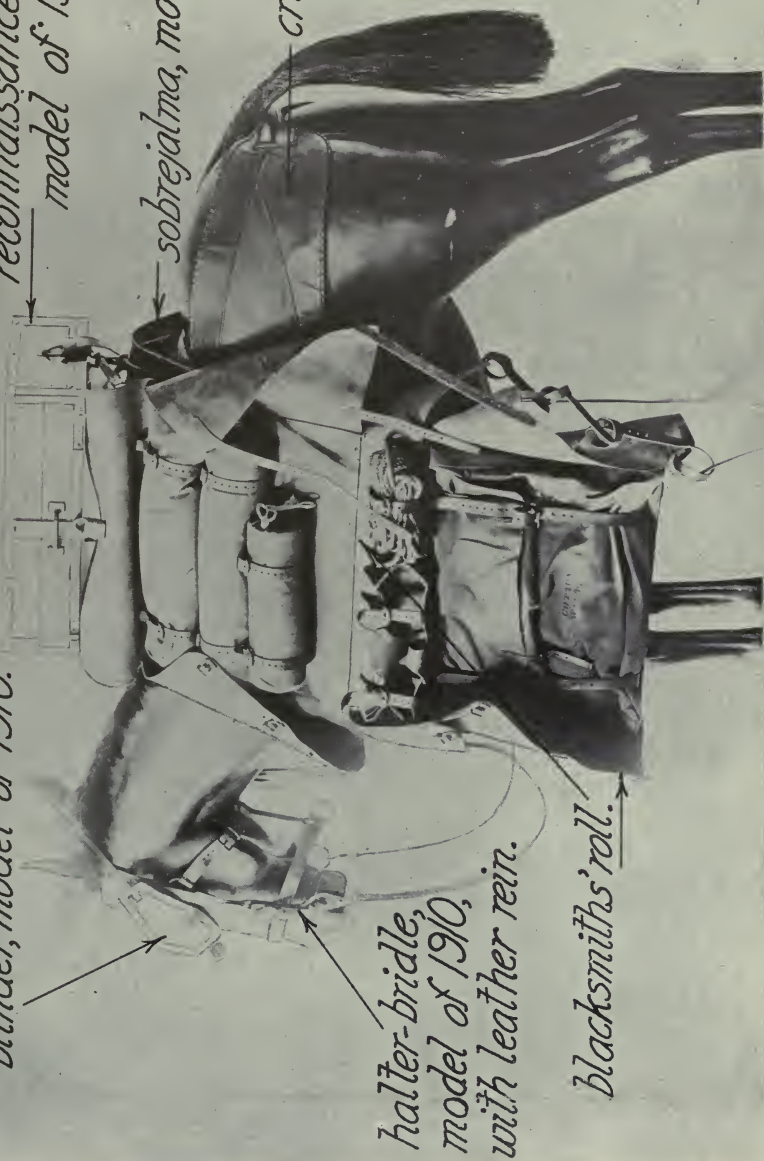
*crupper, model  
of 1910.*

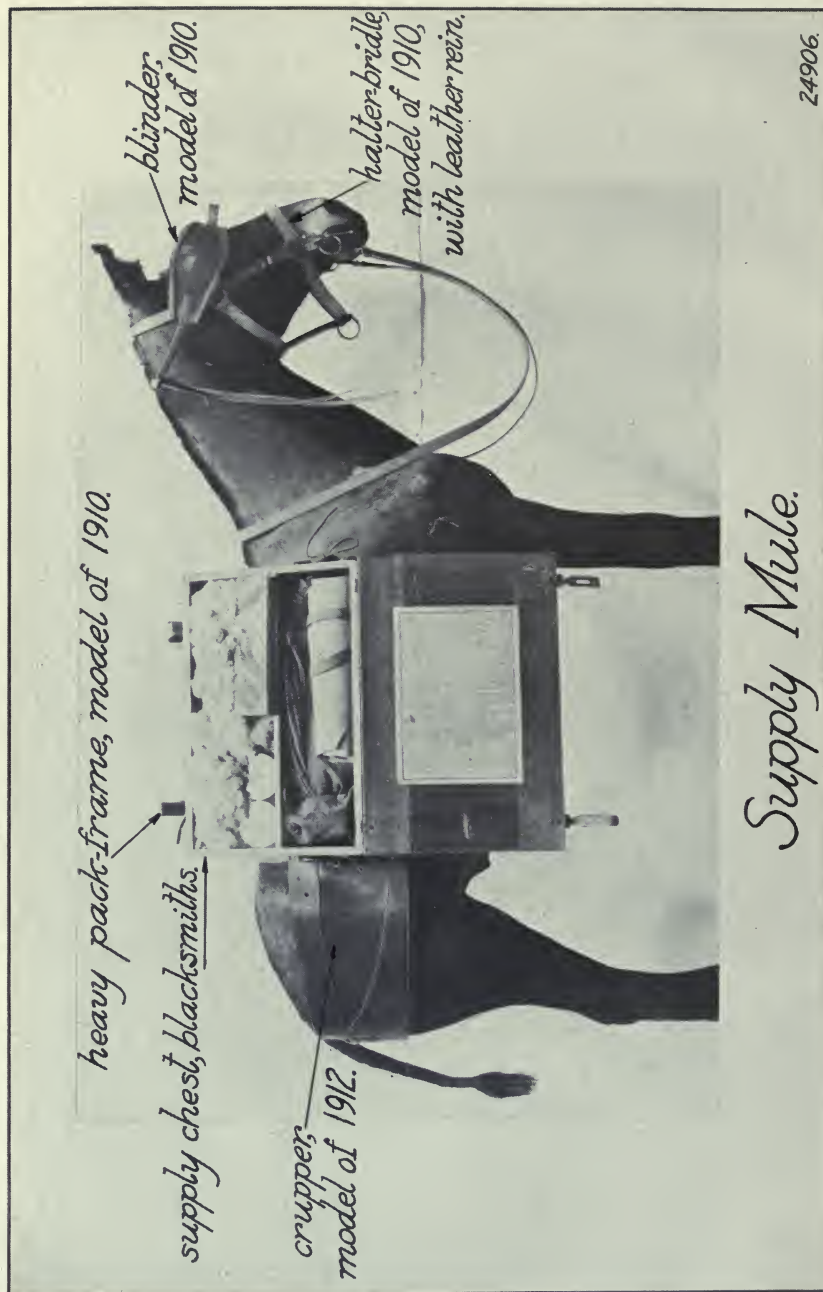
*halter-bridle,  
model of 1910,  
with leather rein.*

*blacksmiths' roll.*

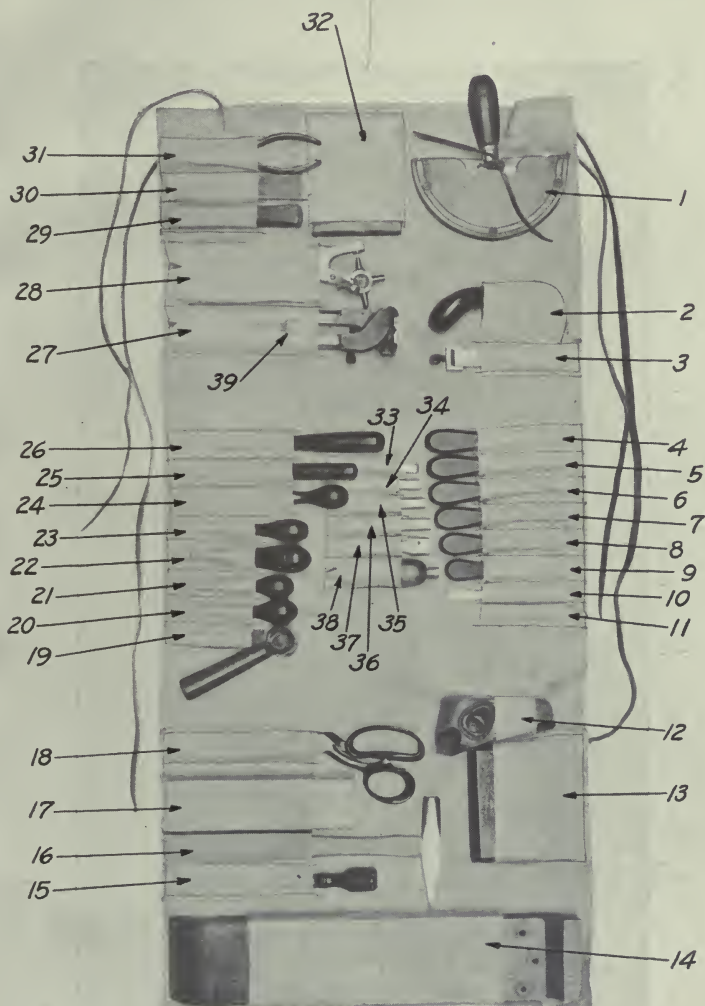
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# *Blacksmiths' Roll.*

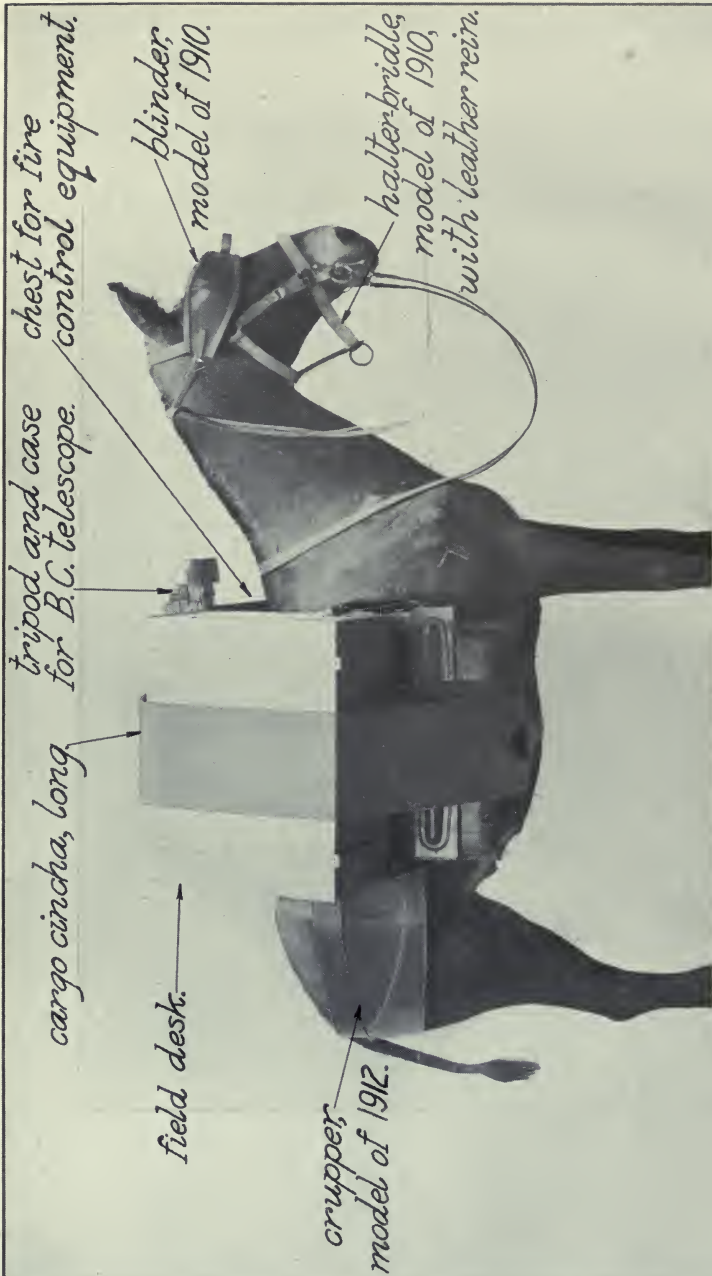








*Saddler's Tool Kit.*



*Signal Mule.*

## LASH CINCHA.

This cincha consists of a cotton-duck body reinforced at the ends with leather. An aluminum hook at one end and a latigo lacing at the other end provide means for connecting the body with the lash rope.

The lash rope and lash cincha are used on the kit packs and are designed to lash down tightly the side loads, generally with a "diamond hitch."

## AXLETREE LEVER SECURING STRAPS.

The spare axletree lever is fastened to the top of the pack frame by means of these straps.

## LOAD STRAPS.

These straps are designed to fasten canvas sacks of spare aparejo sticks to the top of the loads.

## AMMUNITION CHESTS.

Shell and shrapnel ammunition are issued by the Ordnance Department in moisture-proof tin packing cans, hermetically sealed and placed in wooden packing boxes, 4 rounds per box. The weight of a filled box is about 100 pounds for 18-pound projectiles and about 75.5 pounds for 12.5-pound projectiles.

For transportation on mules the rounds, including tin containers, are transferred to the ammunition chests of the pack outfits. The chests for 18-pound projectiles hold 4 rounds each and those for the 12.5-pound projectiles 5 rounds each, the weights when filled being about 108.8 pounds and about 103.8 pounds, respectively. Two ammunition chests are carried on each mule.

## Part II (c).—TOOLS AND ACCESSORIES FOR SPECIAL PACK EQUIPMENT.

Canvas sack for spare sticks.	Spare sights chest.
Chest for fire-control equipment.	Supply chest:
Field desk.	Blacksmith's.
Lantern chest.	Miscellaneous.
Lifting bars.	Saddler's.
Pioneer rolls, right.	Tools.
Pioneer rolls, left.	Canvas watering bucket.
Pouch for spare parts.	Picket rope sections.
Ration crates.	Picket pins and eyes.
Rigging covers.	Blacksmith's tools, set.

A complete list of the tools and accessories for special pack equipment are listed on page 92.

A description of some of these articles follows.

### CANVAS SACK FOR SPARE STICKS.

A sack of olive drab duck, tied with cotton chalk line, is used to carry the spare boot sticks, top sticks, and ribs for the aparejo.

### LIFTING BARS.

These bars are designed to facilitate loading the gun, cradle, and trail to pack.

The collar on the long bar and the bend in the short bar are to prevent the loads slipping toward either end. The thong in each bar is provided for tying it to pack.

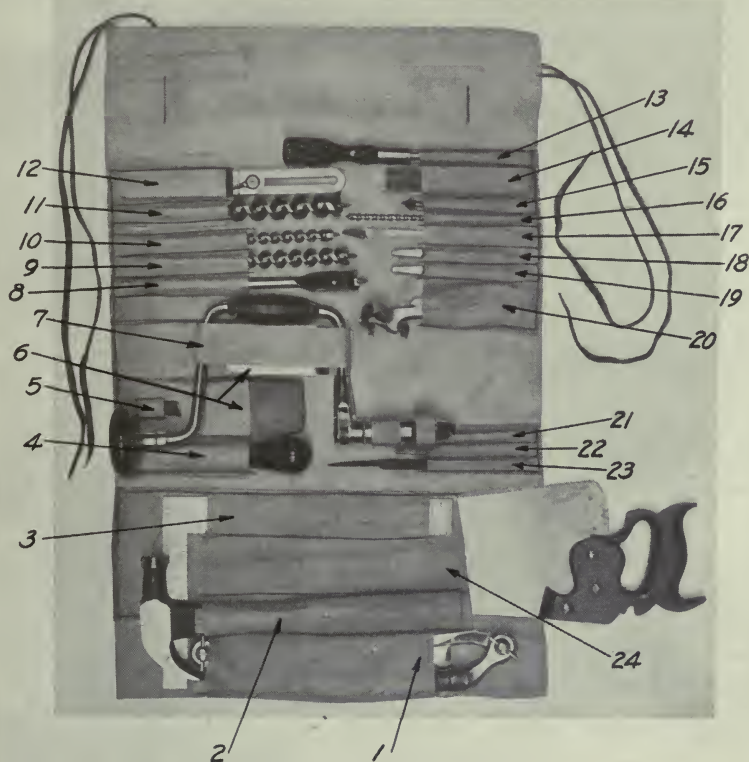
### RIGGING COVER.

The rigging cover, made of olive drab duck, is 43 inches wide and long enough to cover 8 packs of the outfit when in park.

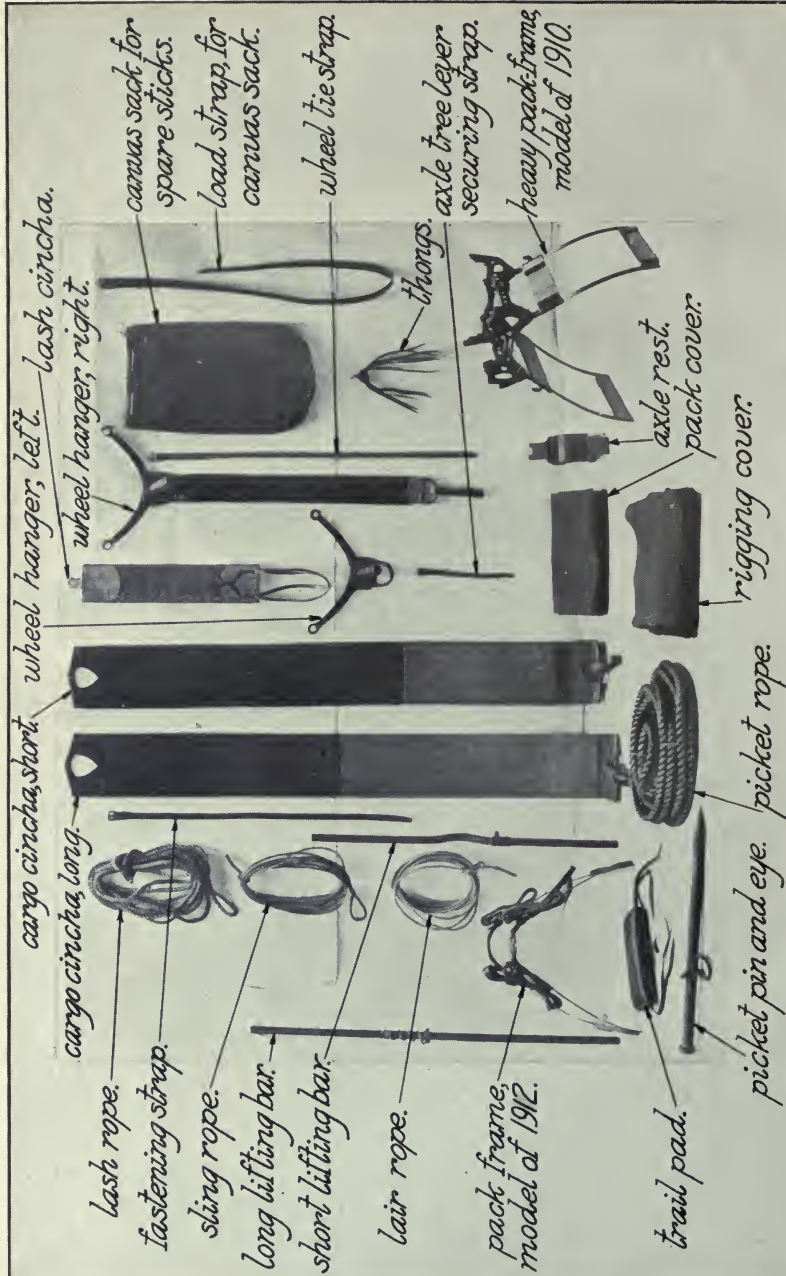
### PICKET-ROPE SECTION AND PICKET PIN AND EYE.

The picket-rope section consists of a 1-inch diameter manila rope 50 feet long with a loop spliced on each end. It is designed to be stretched along the ground and fastened at the ends with pins. The animals can then be fastened by means of their halter bridle reins to this rope in the usual way. One pin is provided for each section. Where two sections are used together the sections of rope can be fastened together by means of the loops and a pin driven at each end. If it is necessary to use the sections separately, a shovel or pick mattock could be used as a "deadman."





*Carpenter's Tool Kit.*



## SCHALLER FORGE AND TOOL CHEST.

[Pl. XXIV.]

The Schaller forge and tool chest are parts of the set of blacksmith's tools listed on page 97. They are made entirely of metal. The drivewheel is mounted upon an arm, which can be swung about the center of the blower shaft as an axis. The blower, with the arm, swings about trunnions concentric with the exhaust tube of the blower. The arrangement is such that the entire mechanism may be folded within the body of the forge. When set up for use the forge body is supported by four legs, which are braced by two leg tie-rods. The lid is supported in a horizontal position and forms a shelf for tools, etc.

The tool chest accompanying the Schaller forge contains tools and accessories for use with the forge. The anvil and small vise may be mounted on the tool chest in fixtures provided for that purpose.

The forge and tool chest are suspended from the pack frame by means of hanger bars, one riveted to the lid of the forge and the other to the bottom plate of the tool chest.

## BLACKSMITH'S TOOL KIT.

[Pl. XXV.]

The blacksmiths' tool kit, which is part of set of blacksmiths' tools, is a cloth body to which are stitched leather pockets for carrying the blacksmiths' tools. Two latigo thongs and a leather billet, with buckle and chape, tie the roll into a compact shape for packing into the forge tool chest.

## POUCH FOR SPARE PARTS.

This is a cylindrical shaped leather case used for carrying small spare parts for the carriage and hand-fuze setters listed on page 93. Two fastening straps hold the pouch securely in place on top of the pack frame.

## PACK COVERS WITH ROPES.

Pack covers are made of duck in two pieces each 36 by 72 inches. They are lapped and stitched together in the middle and are hemmed on the ends. They are used to wrap the kit packs in before placing on the mule.

There are provided four manila ropes: A lash rope, 50 feet long, a sling rope, and two lair ropes, each 30 feet long, which bind the kit packs and hold them tightly in place on the mule.

## PIONEER ROLLS.

[Pls. XVI and XVII.]

The pioneer's pack consists of two rolls, one right and one left, each carrying the tools as listed on page 91.

A pioneer roll is a leather body with straps for holding the tools. A pack body strap, attached to the body proper by keepers, holds the roll compactly together for transportation. Riveted to the back of the roll is a hanger bar by which the load is suspended from the pack frame.

#### SUPPLY CHESTS.

The four supply chests are made of wood, reinforced by corner and reinforce plates. A partition divides the interior into two compartments to accommodate the supplies carried. To the bottom of the chest is riveted a hanger bar by means of which the chest is suspended from the pack frame, one on each side of the mule. By means of a pack cincha rope and two top straps, the former passing under the aparejo and the latter passing through strap fasteners screwed to each end of the chest, the load is held securely to the pack frame. A Yale lock with chain attachment is furnished with each chest.

For lists of tools carried in these chests see pages 97 and 98.

For supplies carried in these chests, see pages 98, 99, and 100.

#### SADDLERS' TOOL KIT.

[Plate XX.]

The harnessmakers' tool kit is a leather body provided with pockets for carrying the tools as listed on page 96. Two latigo leather thongs bind the kit together for loading into the supply chest, carried on the left side of the supply-chest mule.

#### CARPENTERS' TOOL KIT.

[Plate XXII.]

The carpenters' tool kit is a leather body provided with pockets for carrying the tools as listed on page 97. Two latigo leather thongs bind the kit together for loading into the supply chest.

#### DUMMY PACKS.

A dummy pack consists of two bodies, two straps, two ropes, two keepers, two hooks, four hanger eyes, and four rope rings. The bodies are flat pieces of cast iron, with lugs and hanger eyes on their underside which engage the pack frame, and are strapped to the pack harness by means of the ropes, straps, and smaller parts.

For the purpose of exercising the mules under loads without having to use the regular loads, dummy packs are manufactured and will be issued on special requisition, if desired, by the battery commander in sufficient quantity for 28 mules per battery.



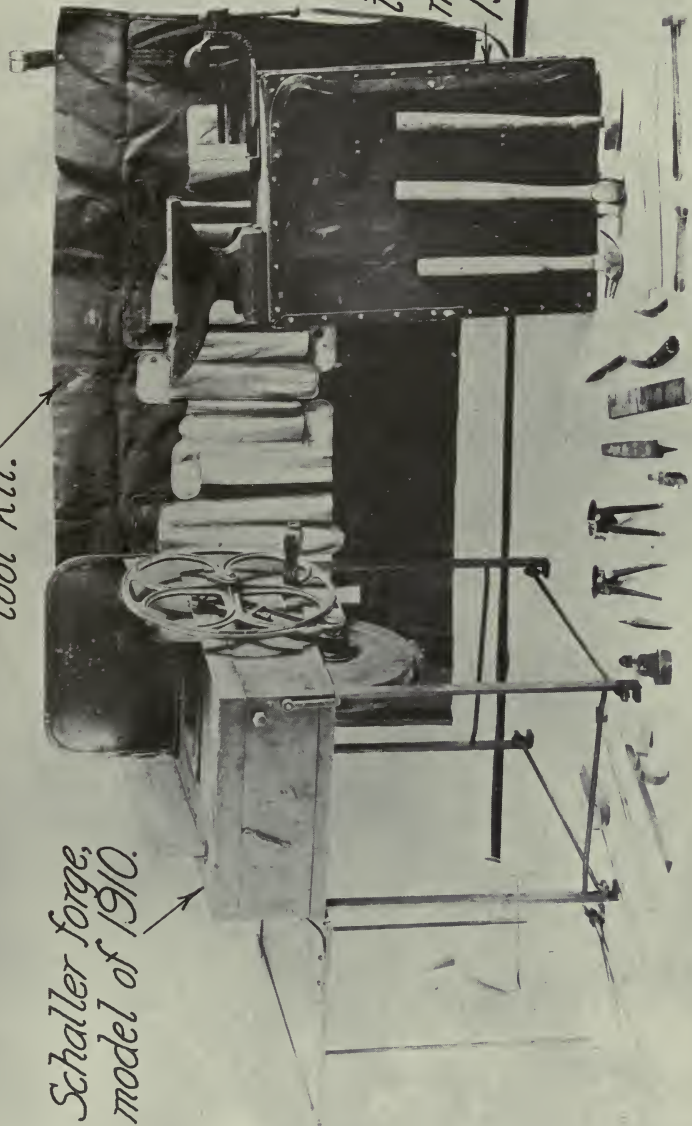
tool kit.

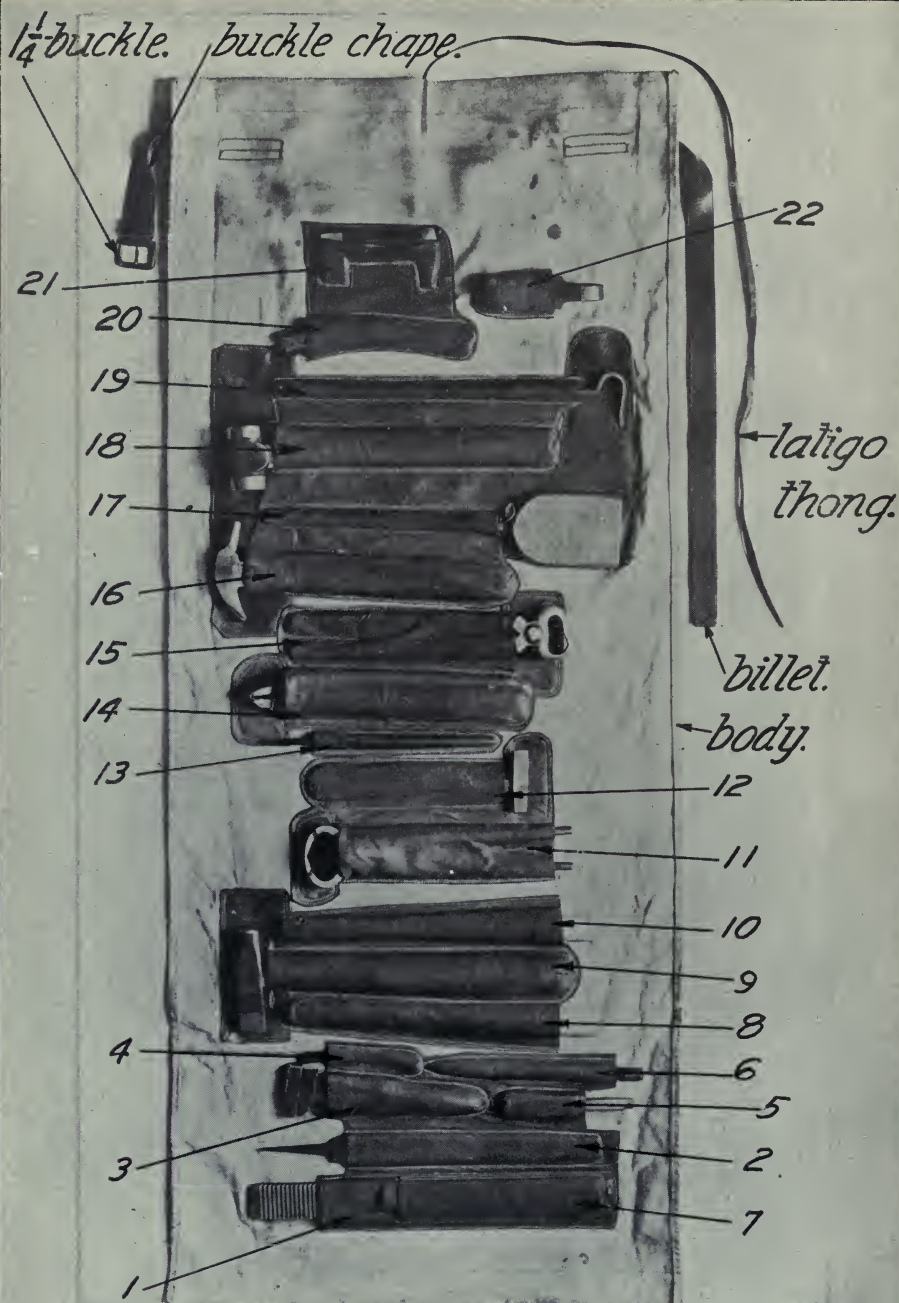
Schaller forge,  
model of 1910.

tool chest,  
model of  
1910.

22455

Schaller Forge, Model of 1910.





23243

*Blacksmiths' Tool Kit.*

### Part III.—ALLOWANCE OF AMMUNITION.

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The annual allowances of ammunition for the instruction of mountain artillery is prescribed from time to time in War Department Orders. These orders give full information as to the allowances of fixed and blank ammunition for the 2.95-inch mountain guns, sub-caliber cartridges, pistols, and shotguns and care of the same, disposition of empty shells, etc.

#### TARGETS.

Description and allowances of mobile artillery targets and accessories are given in the pamphlet, Ordnance Department Form No. 1994.



## Part IV.—GENERAL INFORMATION.

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### PAINTING ARTILLERY MATÉRIEL.

The paint issued for this purpose is of olive-drab color put up in 5-pound cans ready for use, and is applied to both wood and metal parts. If the paint is too thick, turpentine should be used as a thinner, but not to greater extent than 2 per cent by volume.

All steel and iron nonbearing surfaces should be painted. Wearing and bearing surfaces, teeth of gear wheels, elevating screws, piston rods, cylinders, counter-recoil springs, and interior of cradle should not be painted.

All parts to be painted should be free from dirt or grease. They may be washed in a liquid made by dissolving one-half pound sal soda in 8 quarts of warm water, then rinsed in clean water, and wiped thoroughly dry.

Where the matériel is in fair condition and only marred in spots, the marred places should be primed with olive-drab paint, second coat, and permitted to dry. Then the whole surface should be sandpapered with No. 1½ sandpaper and a coat of paint applied and allowed to dry thoroughly before use.

Where the matériel is in bad condition all parts should be thoroughly sandpapered with No. 2½ sandpaper, be given a coat of paint, and be permitted to dry for at least 24 hours; then sandpapered with No. 00 sandpaper, apply a finishing coat, and permit the parts to dry thoroughly before use.

Articles which can be easily cleaned and repainted may be immersed in the solution. *It is forbidden to immerse articles which can not be entirely repainted*, for example: Ammunition chests, the joints, and some parts of the interior of which it would not be practicable to repaint.

In general, two coats of paint per year will be sufficient to keep the matériel in good condition. After repeated painting the paint may become so thick as to scale off in places or give an unsightly appearance. It may then be removed for repainting, as follows:

Dissolve 1 pound of concentrated lye, powdered form, in 6 pints of hot water, and slake in enough lime to give the solution the consistency of paint. Use the solution freshly mixed and apply to the parts where paint is to be removed with a brush or with waste tied to the end of a stick. When the solution begins to dry on the surface



use a scraper to remove the old paint, and complete the cleaning of the surface with cloth and water. If one application is not sufficient to loosen the paint, apply a second coat. Before painting wash the surface with sal soda water, rinse with clean water, and then wipe thoroughly as described above.

#### OIL FOR ARTILLERY MATÉRIEL.

For the service, cleaning, and preservation of this matériel the Ordnance Department issues hydroline oil, lubricating oil, clock oil, sperm oil, coal oil, neat's-foot oil, and light slushing oil. Each of these oils is suited for the particular purpose for which it is issued, as stated below, and care should be taken that it is not used for other purposes.

The hydroline oil is for use in the recoil cylinders of the carriages *and for no other purpose*.

The lubricating oil will be used exclusively in all oil holes of the matériel and in lubricating such parts as wheels and axles, gun slide, and elevating mechanisms, hinges, different surfaces of breechblocks, threads of breech recess, etc.

Clock oil should be used on all bearings of the panoramic sight, and fuze setters, and worms of the rear sight.

In all cases clock oil should only be used when the instruments mentioned are disassembled for cleaning. When used it should be applied by dropping from the end of the dropper attached to the end of the cork.

The sperm oil is a lighter lubricant than the lubricating oil, and may be used on the gears of sights, fuze setters, parts of pistols, etc.; lubricating oil may also be used on such parts.

Coal oil is used by the Ordnance Department for cleaning purposes. In the field it may be used for lanterns. Coal oil for general illuminating purposes is furnished by the Quartermaster's Department.

Neat's-foot oil is used for the care and preservation of all leather equipment.

Light slushing oil is prescribed for use in the protection and preservation of all bright or unpainted surfaces of steel or iron on all parts of the equipment when the matériel is to remain unused for an appreciable length of time. Its use as a lubricant for mobile artillery is forbidden.

Before applying the slushing oil to any surface, the part should be thoroughly cleaned, so as to be free from rust, water, coal oil, lubricating oil, etc., as their presence will cause rusting under the slushing oil. The slushing oil should then be applied in a *thin, uniform coat*, since this is ALL that is necessary to give good protection.

Except in very cold weather it can be applied by using a paint brush as when painting; in cold weather it should be **applied by**

stippling—that is, lightly tapping the surface with the end of the sash tool held with bristles perpendicular to the surface to be covered. It can be applied to the bores of guns by the slush brush issued for the purpose. In cold weather it should be warmed before use for coating the bores of guns.

It may be readily removed by the use of burlap or waste dipped in coal oil.

#### REPAIRS FOR FIELD ARTILLERY MATÉRIEL ISSUED TO THE UNITED STATES ARMY AND THE NATIONAL GUARD.

Instructions relative to making repairs to field batteries and furnishing ordnance stores and supplies for them will be found in the general orders issued by the War Department from time to time.

Instructions in reference to the care, use, and repair of delicate instruments, such as sights, telescopes, and range finders will be found in General orders, No. 47, War Department, Washington, March 24, 1905, and in O. O. pamphlet, Form No. 1795.

#### INSTRUCTIONS FOR RIVETING.

Whenever a rivet is broken, loose, or needs replacing for any reason the rivets should be heated to a light yellow (just below white) color. They may be heated in the forges furnished with the battery equipment or in a permanent blacksmith's forge. While heating keep the rivets covered with coals in order to prevent scaling. Rivets one-fourth inch and less in diameter may be driven cold when it is impracticable to heat them. Drive them hot, however, when practicable. Drive all rivets greater than one-fourth inch in diameter hot in all cases. Do not overheat or burn the rivets. Remove all scale from rivets after heating and before driving. Drive the rivets home with a hammer before attempting to form the head. Hold rivets solidly in place with a sledge, crowbar, and fulcrum, railroad iron or similar heavy piece of steel. Partially form the head with the face and peen end of a hammer. When the head is practically formed by this operation use a rivet set for final forming of the head. The rivet set is only for this final operation. Loose rivets will result if they are not peened down with a hammer before the rivet set is used. The rivets must be held solidly in place while the riveting is being done, otherwise loose rivets result.

Before starting to heat the rivets the pieces to be riveted should be carefully fitted and bolted together. If the holes in the two pieces are not in perfect alignment the cause should be determined and rectified instead of attempting to drift the pieces into alignment. If necessary for perfect alignment a slight amount of reaming or filing will be permitted. In no case should a rivet hole be reamed

larger than about one-sixty-fourth inch in excess of the diameter of the rivet. On account of inaccessibility, it is sometimes difficult to insert a rivet. In such cases it may be inserted with a twisted stiff wire or with a small wooden stick split at the end to hold the rivet. Arrangements must be made beforehand to back up or hold the rivet in place the instant it is located in order that it may not have cooled too much for proper riveting. Hot riveting is preferable to cold riveting as the head is more easily formed when hot and the contraction of the rivet in cooling gives a tighter fit.

#### SUGGESTIONS FOR CARE AND MAINTENANCE OF MATÉRIEL.

Various suggestions in reference to the care of this matériel and hints regarding things to be done or to be avoided are scattered throughout the text of this handbook; some of the more important are here condensed for more convenient reference. Careful compliance with these suggestions will avoid delay and possible injury to personnel or matériel.

The firing pin should habitually be carried uncocked.

Recock carefully with a lanyard after a hangfire or a misfire. The breechblock should not be opened for at least one minute after a misfire.

All work upon the recoil system, sights, and other optical equipment should be done in the presence of a commissioned officer.

See that proper kind of oil is used in cylinders and for lubrication.

Strain the oil used in filling the cylinders through a fine clean cloth and be sure that the receptacles used in handling the oil are clean.

Take every precaution to keep the interior of the cylinders clean and to prevent the entrance of foreign particles.

Lash parts with copper wire to prevent unscrewing.

Before firing, inspect to insure that cylinders are properly closed and that the piston rods are locked in place.

If time permits, oil slides before firing.

Note length of recoil for first few shots to insure that the recoil mechanism is working properly.

If the gun fails to return fully into battery, it is probably due (1) to dirt on slides and guides; (2) to cutting of sliding surfaces on account of dirt and lack of oil; (3) to gland being screwed up too tightly; (4) to dirt or foreign particles in the cylinder; (5) to weakness of springs. Ninety per cent of such cases will be found due to (1), (2), or (3).

Replace and properly open all split pins after replacing nuts.

Prevent possible injury to cannoneers by causing them to stand clear of the counter-recoil-spring column in assembling or dismounting.



Do not strike any metal part directly with a hammer; interpose a buffer of wood or copper:

Frequently verify the adjustment of sights and quadrant.

Require special care in handling sights.

Be sure that the range strip of the rear-sight shank is graduated for the particular type of ammunition used by the battery.

Do not unnecessarily expose ammunition to the sun or load it into a warm gun before time for firing; if this is done, erratic shooting may result.

Battery commanders should frequently make a detailed inspection of all of the vehicles in the battery to see if any part of them are broken and any nuts, screws, split pins, etc., missing. If any such defects are found, he should immediately take steps to replace broken or missing parts. This is of the utmost importance, and compliance with these instructions will do much toward prolonging the life of the vehicles.

All nuts are secured by split pins, which should be replaced and properly opened when nuts are screwed home.

See that fuzes are set at safety for transport.

Use the small primer-inserting press for inserting primers in cartridge cases and the decapping tools provided for removing old primers.

In all requisitions and correspondence the correct name of the part referred to (if known) should be given. If the name of the part is not known, submit a sketch showing the location, shape, matériel, etc., sufficient to establish definitely the identity of the parts in question.

The use of the word "complete" in requisitions to signify a combination of parts sometimes leads to misunderstanding of the exact parts wanted. The tables of nomenclature of parts have been arranged to show the parts included under the terms "one trail, complete; one wheel, complete," etc., and should be carefully studied before requisitions are made out to insure that all the parts wanted are included and duplications avoided. For example, if a piston rod is wanted, the order should state whether it is to be with or without the piston head. If all details are itemized, it will avoid mistakes and unnecessary expense.

*Smokeless powder must not be used for blank charges.*

#### SUPPLIES IN GENERAL.

All bits, both curb and snaffle, are made of 27 per cent nickel steel, a practically noncorrosive metal.

The olive-drab saddle blanket is regulation for all arms of the service.

The supply of ammunition to be kept on hand in a 2.95-inch-gun battery will be a sufficient amount to fill all the ammunition chests



of the equipment and, in addition, a sufficient number of rounds to cover the needs for annual target practice.

Pistol arm racks are issued for use of Mountain Artillery in such number as may be required to hold the pistols on hand in the battery. Each pistol arm rack holds 80 pistols.

A reloading and cleaning outfit for 2.95-inch guns for removing fired primers from and cleaning cartridge cases and for reloading blank ammunition is furnished to each battery.

#### METHOD OF LOADING THE BATTERY EQUIPMENT ON RAILROAD CARS.

The equipment of a battery of mountain artillery can be placed on one freight box car or two gondola cars. The first is far preferable, as the equipment will pack better and there is cover. The gondola cars should be used only in emergency. In loading, the boxes in which the equipment was originally packed should be used for long trips; otherwise the following method is suggested:

The guns and carriages should be assembled and located in one end of the car, each carriage being blocked to the floor, the tools for each carriage being tied in a bundle and placed underneath the carriage. The frames for carrying the gun, etc., should be nested in the same end of the car, together with the sets of pack harness which belong to the same. Each set should be tied together with the cincha, the corona, saddle blanket, etc., being first folded inside of the same. The remaining frames should be similarly nested in the other end of the car. The remaining sets of pack harness should be tied as above and packed one on top of the other. All packs, tools, etc., should be lashed with rope. The ammunition and kit packs should be the last items packed. The ammunition should be placed in the middle of the car and the kit packs thrown in to steady the load.

### **EQUIPMENT.**

The following table sets forth the total equipment of one 2.95-inch mountain gun battery on war footing. A column shows in general where each article should be carried, but the battery commander may use his discretion as to the disposition of such articles for which no particular fitting is provided or for which no place is shown.

Name of article.	Weight of each (pounds).	Firing battery, mules.							Combat train, mules.					Total for one battery.	Class.	Property classification.
		Gun.	Cradle.	Wheel.	Trail.	Ammunition.	Pioneer.	Signal.	Instrument.	Ammunition.	Supplies.	Supplies.	Forge.			
<i>Equipment issued with four guns.</i>																
Gun.....	235	1														4
Cradle.....	186		1													4
Wheel.....	65.5			2												8
Axle.....	46.5			1												4
Trail.....	231				1											4
Ammunition, rounds.....	15.56					10										1 684
Sight model of 1912, panoramic sight, test wrench for panoramic sight and sight case.....	25.4		1													4
Hand fuze setter in case.....	3.68		2													8
Tools and accessories for gun and carriage (see list on p. 91).....																4
Spare parts for gun (see list on p. 91).....																8
Spare parts for carriage (see list on p. 91).....																4
<i>Packs for one battery.</i>																
(1) The pack harness.....	80.3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	79
Blinder, model of 1910 <sup>2</sup> .....																
1 halter bridle, model of 1910.....																
1 corona, model of 1915.....																
1 saddle blanket.....																
1 aparejo, model of 1911 (with hay, 6 pounds) <sup>3</sup> .....																
1 sobrejalma, model of 1910.....																
1 aparejo cincha, model of 1910.....																
1 crupper, model of 1912.....																

Footnotes on p. 90.

Statement of total equipment of one 2.95-inch mountain gun battery—Continued.

Name of article.	Weight of each (pounds).	Firing battery, mules.								Combat train, mules.				Total for one battery.	Class.	Property classification.
		Gun.	Cradle.	Wheel.	Trail.	Ammunition.	Pioneer.	Signal.	Instrument.	Ammunition.	Supplies.	Supplies.	Forge.	Kit.		
		1	2	3	4	5-11	12	49	50	51-64	65	66	67	68-79		
<i>Packs for one battery—Continued.</i>																
(2) The special pack equipment:																
Case rest.....									1						1	
Hanger, 1-meter base range finder, and B. C. telescope tripod.....															1	
Heavy pack frame.....	32	1	1	1	1		1		1		1	1	1		24	
Hanger, aiming circle, and tripod and range finder, 1-meter base tripod and adjustment bar.....															1	
Pack frame model of 1912 <sup>5</sup> .....	16.5					1			1	1					43	
Wheel hanger—															4	
Right <sup>6</sup> .....	13			1											4	
Left <sup>7</sup> .....	12			1											4	
Wheel tie strap.....	.3			1											4	
Axle rest.....	2.5			1											4	
Fastening straps.....	.25			2											8	
Trail pad.....	1.5				1										4	
Cargo cincha—																
Long.....	8.5					1				1					43	
Short.....	6				1										12	
Lash cincha.....	1.6	1	1											1	12	
Axle-tree lever securing strap.....	.33					2									2	
Load strap for spare stick sack.....	1					2									14	
Ammunition chest <sup>8</sup> .....	26					2				2					84	
															VI	2

Footnotes on p. 90.





## NOTES FOR TOTAL EQUIPMENT TABLE.

- <sup>1</sup> Two hundred and sixty-four rounds carried on wagons.
- <sup>2</sup> Ten blinders are issued per battery.
- <sup>3</sup> The hay is not furnished with the aparejo.
  - One aparejo consists of—
    - 1 aparejo body.
    - 1 aparejo frame (model of 1911), comprising—
      - 1 aparejo top-stick body, right.
      - 1 aparejo top-stick body, left.
      - 1 aparejo boot-stick body, right.
      - 1 aparejo boot-stick body, left.
      - 2 aparejo keys.
      - 1 aparejo top-stick plate, right.
      - 1 aparejo top-stick plate, left.
      - 1 aparejo boot-stick plate, left.
      - 1 aparejo boot-stick plate, right.
      - 2 sets of aparejo ribs (10 to the set).
    - 2 thongs,  $\frac{1}{4}$ " by 64 inches.
    - 2 thongs,  $\frac{1}{4}$ " by 20 inches.
    - 2 thongs,  $\frac{1}{4}$ " by 16 inches.
    - 2 thongs,  $\frac{1}{4}$ " by 14 inches.
- <sup>4</sup> One heavy pack frame consists of—
  - 1 pack-frame tie-brace, right.
  - 1 pack-frame tie-brace, left.
  - 1 pack-frame pommel.
  - 1 pack-frame cantle.
  - 4 pack-frame pins and split pins.
  - 2 pack-frame sides, consisting of—
    - 4 side braces.
    - 2 side bars.
    - 2 side-bar boards.
    - 2 brace bars.
    - 2 brace, bar boards.
    - 4 hook hinges, 2 right, 2 left.
- <sup>5</sup> One pack frame, model of 1912, consists of—
  - 1 pack-frame body, consisting of—
    - 2 pack-frame sides, comprising—
      - 4 side braces.
      - 2 side bars.
      - 2 side-bar boards.
      - 2 brace bars.
      - 2 brace-bar boards.
      - 4 hook hinges.
    - 2 arches.
    - 4 strap-loop clevises.
    - 4 pack-frame pins with split pins.
  - 4 pack-frame top straps.
  - 4 top-strap rendering rings.
- <sup>6</sup> Wheel hanger, right, consists of—
  - 1 wheel hanger yoke.
  - 1 wheel hanger arm.
  - 2 wheel hanger buffer pieces.
  - 1 wheel hanger hinge strap.
  - 1 wheel hanger loop.
  - 1 wheel hanger cincha and strap.
- <sup>7</sup> Wheel hanger, left, consists of—
  - 1 wheel hanger yoke.
  - 1 wheel hanger arm.
  - 2 wheel hanger buffer pieces.
  - 1 wheel hanger hinge strap.
  - 1 wheel hanger "D" ring.
- <sup>8</sup> A number of 18-pound projectiles will be issued in lieu of 12.5-pound projectiles until supply is exhausted. Eight rounds of 18-pound shell per pack are carried and the number of each on hand should be in proper proportion.

## List of tools and accessories, and spare parts for the gun and carriage.

Name of the article.	Weight of each.	Number required for one gun or carriage.	Where carried.	Number required for one battery.	Property classification.	
					Class.	Section.
<i>Tools and accessories for gun and carriage.</i>						
	<i>Pounds.</i>					
Brake rope.....	3.75	2	On wheel mule.....	8	IV	
Handspike.....	5.8	1	On trail mule.....	4		
Breech cover.....	1	1	On gun mule.....	4		
Buffer-spring case.....	1.5	1	On cradle mule.....	4		
Cleaning brush.....	.4	1	do.....	4		
Cradle tompions (set).....	3.1	1	do.....	4		
Piston-rod protector.....	.05	2	do.....	8		
Sponge brush and rod.....	5.3	1	On wheel mule.....	4		
Sponge brush cover.....	.8	1	do.....	4		
Horizontal oiler filled model of 1913.....	1.7	1	On trail mule.....	4		
Muzzle cover.....	.4	1	On gun mule.....	4		
Tool pocket with inside pockets, filled.....	7.6	1	On cradle mule.....	4		
Tool pockets with inside straps, filled.....	7.6	1	do.....	4		
Drift.....		1	In tool pocket with inside straps.....	4		
Funnel.....		1	do.....	4		
Hammer.....		1	do.....	4		
Pinch bar and tommy.....		1	do.....	4		
Screw driver.....		1	do.....	4		
Spanner and screw driver.....		1	do.....	4		
Spanner wrench.....		1	do.....	4		
Spring compression tool.....		1	do.....	4		
Steel drift.....		1	do.....	4		
Wrench.....		1	do.....	4		
Pliers.....		1	In tool pocket with inside straps.....	4		
File, dead, smooth, 6 inches, 3 square.....		1	do.....	4		
File, hand, smooth, 8 inches, flat.....		1	do.....	4		
Lanyard.....	.5	1	In gunner's pouch.....	4		
Gunner's quadrant pouch.....			Carried where convenient.....	1		
Gunner's quadrant.....			In quadrant pouch.....	8		
Leather case for hand-fuze setter.....		2	On cradle mule.....	8		
Oil can, tubular, filled.....	6	2	On ammunition mule.....	8		
Oil-can carrier, tubular.....	2	1	do.....	4		
Gunner's pouch.....	.6	1	On trail mule.....	4		
Sight case.....	10.5	1	On cradle mule.....	4		
Pouch for spare parts.....	8.8		On ammunition mule.....	4		
Gunner's quadrant chest.....			Not carried in field.....	1		
<i>Spare parts for gun.</i>						
	<i>Total weight.</i>					
Carrier axis pin with split pin.....	.66		In tool pockets with inside pockets.....	1		
Extractor.....	1.38		do.....	1		
Extractor axis pin with split pin.....	.42		do.....	1		
Firing pin.....	2.75		do.....	4		
Firing-pin point.....	.19		do.....	8		
Guide plate.....	.86		do.....	1		
Hand lever.....	2.44		do.....	1		
Hand-lever axis pin with split pin.....	.56		do.....	1		
Hand-lever catch.....	.67		do.....	1		
Hand-lever catch pivot.....	.125		do.....	4		
Hand-lever catch spring.....	.125		do.....	4		
Locking bolt.....	.31		do.....	4		
Locking bolt spring.....	.69		do.....	4		
Main spring.....	1		do.....	40		
Split pin for mechanism.....	1.19		do.....	8		
Trigger sear.....			do.....	4		
Trigger spring.....			do.....	4		
Trigger, complete.....			do.....	4		
<i>Spare sights.</i>						
Sight, model of 1912.....	10.37		In spare sight chest.....	1		
Panoramic sight.....	4.25		do.....	1		
Teat wrench for panoramic sight.....	.3		do.....	1		
<i>Spare parts for carriage.</i>						
Axle lever catch.....	.09		In pouch for spare parts.....	1		
Axle-tree lever with nut.....	2.44		On any ammunition mule.....	1		
Buffer-cap packing.....	.24		In pouch for spare parts.....	12		
Buffer spring.....	3.72		In buffer spring case.....	4		
Cradle axis bolt catch.....	.17		In pouch for spare parts.....	1		
Cradle axis bolt catch lever.....	.24		do.....	1		

## List of tools and accessories, and spare parts for the gun and carriage—Continued.

Name of the article.	Weight of each.	Number required for one gun or carriage.	Where carried.	Number required for one battery.	Property classification.	
					Class.	Section.
<i>Spare parts for carriage—Contd.</i>						
	<i>Pounds.</i>					
Cradle axis bolt catch lever split pin.	0.06	.....	In pouch for spare parts—Contd.	4	IV	
Elevating joint pin stop screw.....	.06	.....	do.....	4		
Equalizing spring.....	3.5	.....	do.....	4		
Filling plug, with chain.....	1.31	.....	do.....	2		
Filling plug packing.....	.03	.....	do.....	12		
Lanyard.....	.21	.....	do.....	4		
Linch pin with spring.....	.44	.....	do.....	2		
Piston screw.....	.04	.....	do.....	4		
Piston rod and cup leather packing.....	.19	.....	do.....	12		
Shaft locking screw.....	.19	.....	do.....	6		
Sleeve split pin.....	.38	.....	do.....	4		
Bolts, 0.375 by 3.125, with nuts.....	.....	.....	do.....	2		

## Tools and accessories and spare parts for the special pack equipment.

Name of part.	Weight of each (pounds).	Number required for one gun or carriage.	Where carried.	Number required for one battery.	Property classification.	
					Class.	Section.
<i>Tools and accessories for special pack equipment.</i>						
Ax.....			In pioneer roll, 3 right, 3 left.....	24	IV	9
Bag for hardware.....			In supply chest, saddler's.....	2	X	10
Ball peen hammer.....			In pioneer roll, 1 right, 1 left.....	8	IV	2
Bench ax.....			In pioneer roll, 1 right.....	4	IV	9
Blacksmith's apron for saddler.....			In supply chest, blacksmith's.....	1	X	9
Bag for nails.....			do.....	2	X	10
Bag for borax.....			In supply chest, saddler's.....	1		
Bag for rivets.....			do.....	3		
Bag for tacks.....			do.....	4		
Bag for sponges, thread, and wax, 1 each.....			do.....	3		
Bag for horseshoe nails.....			In supply chest, blacksmith's.....	2	IV	2
Canvas sack for spare sticks, filled.....	10.2		On ammunition mules.....	6		
Canvas watering bucket.....	1.5		1 pioneer mule, 1 kit mule, 1 gun mule.....	20	IV	9
Coal bag.....			In supply chest, blacksmith's.....	1	X	10
Cross peen hammer.....			In pioneer roll, 1 right, 1 left.....	8	IV	2
Field desk.....	97		On signal mule.....	1		
Long-handled shovel.....			In pioneer roll, 3 left.....	12	IV	9
Long lifting bar.....	5.2	1	On trail mule.....	4	IV	2
Oil can, rectangular.....			In supply chest, miscellaneous.....	2	IV	9
Pickax.....			In pioneer roll, 1 right, 2 left.....	12		
Pick mattock.....			In pioneer roll, 2 right, 1 left.....	12		
Pliers.....			In pioneer roll, 1 left.....	4		
Picket rope section.....	13.5		On ammunition mule.....	10		
Picket pin and eye.....	12		do.....	11	IV	2
Pioneer roll, right.....	77.5	1	On pioneer mule.....	4		
Pioneer roll, left.....	78.5	1	do.....	4		
Rigging cover.....	16		On ammunition mule.....	14	X	10
Rope (50 feet).....			In supply chest, blacksmith's.....	1		
Ration crates.....	15.5		On ration mule.....	2	IV	2
Short lifting bar.....	4.5	3	On cradle and gun mules.....	12	X	9
Set of blacksmith's tools.....	205		On forge mule.....	1		
Set of carpenter's tools.....			In supply chest tools.....	1		
Sledge.....	11.5		Pioneer roll, left.....	1	IV	9
Set of saddler's tools.....			In supply chest tools.....	1	X	9
Supply chest, blacksmith's.....	96		On supply mule.....	1		
Supply chest, tools.....	96		do.....	1		
Supply chest, miscellaneous.....	107		do.....	1		
Supply chest, saddler's.....	107		do.....	1		
Short-handled shovel.....			3 in pioneer roll, right.....	12	IV	9
Spare sight chest.....	13.47		On ammunition mule.....	1		
Lantern chest, containing 2 lan- terns.....	22	2	On pioneer mule 1; remainder on ammunition mules.....	8		



## Tools and accessories and spare parts for the special pack equipment—Continued.

Name of part.	Weight of each (pounds).	Number required for one gun or carriage.	Where carried.	Number required for one battery.	Property classification.		
					Class.	Section.	
<i>Spare tools and spare parts for special pack equipment.</i>							
Pack harness:							
Aparejo top stick—							
Right.....	6		In sacks for spare aparejo sticks..	3			
Left.....			do.....	3			
Aparejo boot stick—							
Right.....			do.....	3			
Left.....			do.....	3			
Aparejo ribs (sets of 10 ribs)...	2		do.....	6			
Axle rests.....			Not carried in field.....	2			
Sledge handle.....			do.....	1			
Long lifting bars.....			do.....	2			
Short lifting bars.....			do.....	4			
Repair links 0.125 wide (Diamond No. 65).....			In Schaller forge tool chest.....	10			
For pack frame, model of 1912:							
Hook hinges.....			Not carried in field.....	2			
Arches.....			do.....	2			
Strap loop clevises.....			do.....	16			
Pack frame pins.....			do.....	5			
Split pins, $\frac{1}{8}$ -inch diameter, $\frac{3}{8}$ -inch long.....			do.....	75			
Side bar boards.....			do.....	3			
Brace-bar boards.....			do.....	3			
Side bars.....			do.....	3			
Brace bars.....			do.....	3			
Side braces.....			do.....	12			
Heavy pack frame:							
Hook hinge, right.....			do.....	1			
Hook hinge, left.....			do.....	1			
Side braces.....			do.....	8			
Side bar.....			do.....	1			
Side-bar board.....			do.....	1			
Brace bar.....			do.....	1			
Brace-bar board.....			do.....	1			
Pack frames pins.....			do.....	3			
Split pins, $\frac{1}{8}$ -inch diameter $\frac{3}{8}$ -inch long.....			do.....	25			
Steel rivets, assorted, as follows:							
$\frac{1}{4}$ -inch diameter, $\frac{3}{8}$ inch long, round head.....			do.....	60	IV	2	
$\frac{1}{4}$ inch diameter, $\frac{1}{2}$ inch long, round head.....			do.....	60			
$\frac{3}{8}$ inch diameter, $\frac{1}{2}$ inch long, countersunk head.....			do.....	120			
$\frac{3}{8}$ inch diameter, $\frac{1}{2}$ inch long, flat head (head $\frac{1}{2}$ inch diameter, $\frac{1}{4}$ inch high).....			do.....	120			
$\frac{3}{8}$ inch diameter, $\frac{3}{4}$ inch long, flat head (head $\frac{1}{2}$ inch diameter, $\frac{1}{4}$ inch high).....			do.....	120			
$\frac{3}{8}$ inch diameter, $\frac{3}{4}$ inch long, flat head (head $\frac{1}{2}$ inch diameter, $\frac{1}{4}$ inch high).....			do.....	120			
<i>Spare parts for hand fuze setters.</i>							
Model of 1905 M fuze setter:							
Range ring screws.....		4	In pouch for spare parts.....	4			
Handle screws.....		6	do.....	6			
Stop pins.....		3	do.....	3			
Corrector scale screws.....		4	do.....	4			
Clamp shoes.....		2	do.....	2			
Wing nuts.....		2	do.....	2			
0.063 by 0.47 steel pins.....		2	do.....	2			
Stop screws.....		4	do.....	4			
Indices.....		2	do.....	2			
Plungers.....		4	do.....	4			
Plunger springs.....		4	do.....	4			
Model of 1912 fuze setter:							
Range ring screws.....		12	do.....	12			
Corrector scale screws.....		6	do.....	6			
Range indices.....		4	do.....	4			
Index plungers.....		4	do.....	4			
Index springs.....		4	do.....	4			
Guide-plate lock screws.....		4	do.....	4			
Oil-hole screws.....		8	do.....	8			
Index-bar screws.....		8	do.....	8			
Stop-pin screws.....		3	do.....	3			

*Range-finding and fire-control equipment.*

No.	Name of article.	Property classification.	
		Class.	Section.
10	Battery commanders' ruler, wooden.....	V	1
1	Battery commander's telescope and mount, model of 1904, 1905, or 1915.....		
1	Case for battery commander's telescope and mount.....		
	Accessories carried in case:		
	1 teat wrench.....		
	1 pin wrench.....		
	1 screw driver.....		
	1 camel's-hair brush.....		
1	Battery commander's telescope tripod.....		
1	Case for battery commander's telescope tripod.....		
	Flash-lights:		
	With hoods.....		
5	Without hoods.....		
16	Time-interval recorders.....		
2	Chains for time-interval recorders.....		
2	Tape, steel, 100 feet.....		
1	Aiming circle.....		
11	Case for aiming circle.....		
11	Aiming circle tripod.....		
11	Case for aiming circle tripod.....		
21	Range finder, 1 meter base, model of 1916.....		
1	Case for range finder.....		
1	Range-finder tripod.....		
1	Case for range-finder tripod.....		

<sup>1</sup> Will be issued when available.<sup>2</sup> Range finders will be issued without requisition when available.*Instruction equipment.*

No.	Article.	Where carried.	Property classification.	
			Class.	Section.
1	Shrapnel, sectionalized with fuze.....	Not carried in field.....	V	4
1	Shell, sectionalized, with fuze.....	do.....		

*Individual personal equipment.*

No.	Name of article.	Where carried.	Property classification.	
			Class.	Section.
	(a) For enlisted men individually mounted on horse or mule:			
1	Can, bacon, model of 1913.....	Carried by man.....	IX	1
1	Canteen, model of 1910.....	do.....		
1	Canteen cover, dismounted, model of 1910.....	do.....	VII	2
21	Cartridges, ball, pistol.....	do.....		
1	Cup.....	do.....	IX	1
1	Fork.....	do.....		
1	Knife.....	do.....	VII	2
2	Magazines, pistol, extra.....	do.....		
1	Meat can.....	do.....	IX	3
1	Pistol.....	do.....		
1	Pistol belt, without saber ring.....	do.....	IX	1
1	Pistol holster.....	do.....		
1	Pouch for first-aid packet.....	do.....	IX	2
1	Spoon.....	do.....		
1	Spurs, pair.....	do.....		
	Furnished by Quartermaster's Department—			
1	Identification tag.....	do.....		
1	Shelter tent, half.....			
1	Shelter-tent pole.....			
5	Shelter-tent pegs.....			

*Individual personal equipment—Continued.*

No.	Name of article.	Where carried.	Property classification.	
			Class.	Section.
	(b) For dismounted men:			
1	Bolo.....	Carried by man.....	VII	5
1	Bolo scabbard.....	do.....		
1	Can, bacon, model of 1913.....	do.....		
1	Can, condiment.....	do.....	IX	1
1	Canteen, model of 1910.....	do.....		
1	Canteen, cover, dismounted, model of 1910.....	do.....		
21	Cartridges, ball, pistol.....	do.....	VII	2
1	Cup.....	do.....		
1	Fork.....	do.....		
1	Haversack, model of 1910.....	do.....	IX	1
1	Knife.....	do.....		
2	Magazines, pistol, extra.....	do.....		
1	Meat can.....	do.....	VII	2
1	Pistol.....	do.....		
1	Pistol belt, without saber ring.....	do.....		
1	Pistol holster.....	do.....	IX	3
1	Pouch for first-aid packet.....	do.....		
1	Spoon.....	do.....	IX	1
	(c) Horse equipment for each man mounted on a horse:			
1	Bridle, field artillery.....	On horse.....	IX	5
1	Currycomb.....	do.....		
1	Feed bag.....	do.....		
1	Grain bag.....	do.....		
1	Halter headstall.....	do.....		
1	Halter tie rope.....	do.....		
1	Horse brush.....	do.....		
1	Link.....	do.....		
1	Saddle, McClellan, field artillery.....	do.....		
1	Saddlebags, pair.....	do.....		
1	Saddle blanket.....	do.....		
1	Surcingle.....	do.....		
	(d) Horse equipment for each man mounted on a mule:			
1	Currycomb.....	On mule.....	IX	5
1	Feed bag.....	do.....		
1	Grain bag.....	do.....		
1	Halter-bridle, model of 1910 (with leather reins).....	do.....		
1	Horse brush.....	do.....		
1	Link.....	do.....		
1	Saddle, mule, riding.....	do.....		
1	Saddlebags, pair.....	do.....		
1	Saddle blanket.....	do.....		
1	Surcingle.....	do.....		
	(e) For bell and spare horses and spare mules:			
1	Feed bag.....	On horse.....	IX	5
1	Grain bag.....	do.....		
1	Halter headstall.....	do.....		
1	Halter tie rope.....	do.....		
1	Saddle blanket.....	do.....		
1	Surcingle.....	do.....	IX	5
	(f) For pack mule in addition to pack harness:			
1	Currycomb.....	On mule.....	IX	5
1	Feed bag.....	do.....		
1	Grain bag.....	do.....		
1	Horse brush.....	do.....		
1	Surcingle.....	do.....		

<sup>1</sup> Saddles to be equipped with 1 stirrup gaidon socket per battery.

## Miscellaneous equipment.

No.	Article.	Where carried.	Property classification.	
			Class.	Section.
1	Set of decapping, cleaning, and priming tools consisting of:			
	1 storage chest.....	Not carried in field.....	V	5
	1 small primer, inserting press.....	do.....		
	1 bushing.....	do.....		
	1 cleaning brush.....	do.....		
	1 saluting-powder measure.....	do.....		
	1 decapping tool with guide.....	do.....		
	1 case holder.....	do.....		
	1 case-holder stand.....	do.....		
	1 hammer.....	do.....		
4	Subcaliber and drill cartridge kits, each consisting of:			
	1 storage chest.....	do.....	V	5
	3 drill cartridges.....	do.....		
	1 subcaliber cartridge.....	do.....		
	1 cleaning rod.....	do.....		
	1 bristle cleaning brush.....	do.....		
	1 eyepiece.....	do.....		
	1 extension piece.....	do.....		
	In tin box—			
	1 pin wrench.....	do.....		
	2 extractor-spring screws.....	do.....		
	3 rotating pins with locking screws.....	do.....		
	1 closing-cap set screw.....	do.....		
	1 fuze-body locking screw.....	do.....		
	1 closing cap.....	do.....		
	1 graduated time train ring.....	do.....		
	1 time train ring.....	do.....		
1	Marking outfit, model of 1910, for leather, goods, consisting of:			
	1 poplar chest.....		X	
	1 set bronze stamps, including all letters of the alphabet, figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, star, comma, and period.....			
1	Marking outfit, model of 1910, for metal goods, consisting of:			
	1 poplar chest.....	Not carried in field.....		
	1 set steel stamps, including all the letters of the alphabet, figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, the character &, comma, and period.....	do.....		
	1 mallet.....	do.....		
	1 anvil with 3 guides and thumb screw.....	do.....		
1	Seal stamp, consisting of handle and stamps, the letter cut to suit circumstances of issue.....	do.....		
1	Stencil outfit, consisting of:			
	1 stencil-chest outfit.....	do.....		
	1 set letter stencils A to Z, period, and character &, 1-inch size.....	do.....		
	1 set letter stencils A to Z, period, and character &, ½-inch size.....	do.....		
	1 set numbers, 0 to 9, 1-inch size.....	do.....		
	1 set numbers 0 to 9, ½-inch size.....	do.....		
	1 stencil brush.....	do.....		
	1 box stencil paste.....	do.....		
1	Stencil plate, shell and flame.....	do.....	X	
1	Stencil plate, personal equipment.....	do.....		
2	Arm racks, pistol, model of 1913.....	do.....	X	1
1	Pistol-cleaning kit.....	Where convenient.....	X	9
	(For targets, see O. O. Pamphlet No. 1994.)			
	Furnished by Quartermaster's Department:			
	Toe calks (cut to size).....	15 in supply chest, tools.....		
	Mule shoes.....	16 in supply chest, miscellaneous.....		
	Nails, horseshoes..... pounds.....	4 pounds in bag for horseshoe nails.....		
	Coal, blacksmith's..... pounds.....	30 pounds in bag for coal.....		
18	Polo sets (see U. A. E. M.).....	Not carried in field.....	IX	5
11	Cavassons and longes.....	do.....		
145	Halter chains.....	do.....	X	2
12	Fencing outfits, infantry, sets.....	do.....		
18	Fencing outfits, cavalry, sets.....	do.....	IX	5
	Horse covers (see U. A. E. M.).....	do.....		



*Blacksmith's tools for one mountain gun battery.*

No. of article on plate XXV.	Number.	Name of article.	Where carried.	Property classification.	
				Class.	Section.
.....	1	Schaller forge.....	On forge mule.....	X	9
.....	1	Vise.....	do.....		
.....	1	Schaller forge tool chest.....	do.....		
.....	1	Anvil, 34 pounds.....	In Schaller forge tool chest.....		
.....	1	Blacksmith's apron.....	do.....		
.....	1	Shoeing box leather.....	do.....		
.....	1	Blacksmith's tool kit.....	do.....		
.....	9	Chisel, handled for cold iron, 1-pound 6-ounce.....	In blacksmith's tool kit.....		
.....	21	Clinch cutter.....	do.....		
.....	22	Clinching iron.....	do.....		
.....	12	Creaser, steel, handled.....	do.....		
.....	6	Drills, flat.....	For garrison use only.....		
.....	2	File, 12-inch, flat, second-cut.....	In blacksmith's tool kit.....		
.....	13	File, 8-inch, three-square, taper.....	do.....		
.....	19	Fire rake.....	do.....		
.....	17	Fire shovel.....	do.....		
.....	18	Hammer, rounding, 14-inch handle, 2-pound.....	do.....		
.....	16	Hammer, shoeing.....	do.....		
.....	8, 10	Handles, spare, for cold chisel.....	do.....		
.....	5	Hardie, 0.562 ( $\frac{9}{16}$ ), square shank, 1-inch bit.....	do.....		
.....	6	Pritchel, 0.562 ( $\frac{9}{16}$ ), flats, 9-inch.....	do.....		
.....	1	Ratchet drill for square-shank drill.....	For garrison use only.....		
.....	20	Shoeing knife.....	In blacksmith's tool kit.....		
.....	11	Shoeing pincers.....	do.....		
.....	1	Shoeing rasp, 16-inch.....	do.....		
.....	1	Tool kit for Schaller forge.....	In Schaller forge tool chest.....		
.....	14	Tongs, horseshoer's.....	In blacksmith's tool kit.....		
.....	7	Whetstone, farrier's, 10-inch.....	do.....		
.....	3	Wrench, screw, 8-inch, knife-handled.....	do.....		
.....	15	Cutting nippers, 14-inch.....	do.....		

*Carpenter's tools for one mountain gun battery.*

No. of article on plate XXII.	Number.	Name of article.	Where carried.	Property classification.	
				Class.	Section.
.....	1	Carpenter's tool kit.....	In supply chest tools.....	X	9
.....	12	Bevel, 8-inch.....	In carpenter's tool kit.....		
.....	9, 10, 11, 16	Bits, auger, 6 sizes.....	do.....		
.....	6	Bit, double, 2-inch.....	do.....		
.....	5	Bit, expansive, two cutters.....	do.....		
.....	17	Bit, screw-driver, size 0.375 inch.....	do.....		
.....	15	Bit, wood, countersink, 0.625 inch.....	do.....		
.....	7	Brace, ratchet, 10-inch sweep.....	do.....		
.....	3	Chisels, socket framing, three sizes.....	In supply chest tools.....		
.....	18, 19, 21, 22	Drills, twist, sizes $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{8}$ , and $\frac{3}{4}$ inch.....	In carpenter's tool kit.....		
.....	23	File, saw, 6-inch.....	do.....		
.....	1	File, 10-inch, flat, bastard.....	In supply chest tools.....		
.....	2	Hammer, claw, bell face.....	In carpenter's tool kit.....		
.....	4	Handle tool containing 10 tools.....	do.....		
.....	1	Handle, file, aluminum.....	In supply chest tools.....		
.....	1	Knife, drawing, folding and adjustable handle.....	In carpenter's tool kit.....		
.....	1	Oilstone, unmounted.....	In supply chest tools.....		
.....	1	Plane, smoothing, wood.....	do.....		
.....	1	Rasp, wood, 10-inch.....	do.....		
.....	14	Rule, boxwood, 2-foot, 4-fold.....	In carpenter's tool kit.....		
.....	24	Saw, crosscut, 20-inch.....	do.....		
.....	20	Saw set.....	do.....		
.....	13	Screw driver, 5-inch blade, 10-inch.....	do.....		
.....	3	Square, steel, 12-inch body, 8-inch tongue.....	do.....		
.....	1	Wrench, screw, 12-inch.....	In supply chest tools.....		

*Sillier's tools for one mountain gun battery.*

No. of article on plate XX	Number.	Name of article.	Where carried.	Property classification.	
				Class.	Section.
4, 5, 6, 7, 8, 9, 32	1 12	Saddler's tool kit, sheepskin..... Awl blades, harness, assorted, Nos. 43 to 48, inclusive.	In supply chest tools..... In saddler's tool kit.....	X	9
38	1	Awl, pegging.....	do.....		
24	1	Awl seat, handled.....	do.....		
22	1	Carriage, pricking, 3 wheels.....	do.....		
10	1	Compass, 6-inch.....	do.....		
29	1	Creaser, double, lignum vitæ.....	do.....		
20	1	Edge tool, No. 1.....	do.....		
21	1	Edge tool, No. 2.....	do.....		
32	2	Extra blades with followers for draw gauge.....	do.....		
2	1	Gauge, draw, brass, without guard.....	do.....		
16	1	Hammer, No. 3, riveting.....	do.....		
38	1	Handle, peg awl, with wrench.....	do.....		
1	2	Hafts, patent awl, with wrench.....	do.....		
1	1	Knife, round.....	do.....		
1	1	Knife, splitting, 6-inch.....	In supply chest tools.....		
32	1	Needlecase, leather.....	In saddler's tools kit.....		
32	1	Needles, glove's, No. 3, paper.....	do.....		
32	2	Needles, harness, No. 4, papers.....	do.....		
32	2	Needles, harness, No. 5, papers.....	do.....		
32	2	Needles, harness, No. 6, papers.....	do.....		
32	12	Needles, sacking, assorted.....	do.....		
27	1	Nippers, cutting, 10-inch.....	do.....		
17	1	Oilstone, unmounted.....	do.....		
31	1	Pliers, 6-inch.....	do.....		
33, 34, 35, 36	4	Punches, round, assorted.....	do.....	X	9
28	1	Punch, revolving, 4 tubes.....	do.....		
37	1	Rivet set.....	do.....		
30	1	Rule, boxwood, 2-foot, 4-fold.....	do.....		
12	1	Sewing palm, leather.....	do.....		
13	1	Slicker, steel.....	do.....		
18	1	Shears, 10-inch, bent trimmers.....	do.....		
25	1	Shoe knife, broad point.....	do.....		
26	1	Shoe knife, square point.....	do.....		
14	1	Stitching clamp.....	do.....		
15	1	Screw driver, 3-inch blade.....	do.....		
23	1	Tool, claw.....	do.....		
32	2	Thimbles, best aluminum-lined steel, 2 sizes.....	do.....		

*Allowance for six months of cleaning and preserving materials for one mountain battery.*

Number.	Article.	Where carried.		Property classification.	
		In pack.	In store.	Class.	Section.
21	Batteries, everready, Tungsten.....	Carried where convenient.....	2½	X	10
3	Borax, pound, lump.....	½ pound in supply chest, saddler's.	2½		
1	Brush, camel's-hair, No. 1, round.....	do.....	1		
1	Brush, sash No. 3.....	do.....	1		
1	Brush, sash No. 5.....	do.....	1		
1	Brush, varnish No. 4-0.....	do.....	1		
1	Brush, varnish No. 5-0.....	do.....	1		
2	Burners, lantern, Dietz Vesta.....	In supply chest, tools.....	1		
6	Bulb, everready, 2.7-volt, Mazda.....	Carried where convenient.....	2		
2	Cloth, crocus.....	quire.....	2		
1	Cloth, emery No. ½.....	do.....	1		
1	Cloth, emery No. 0.....	do.....	1		
1	Cloth, emery No. 00.....	do.....	1		
2	Cosmic, No. 8 soft, quarts (1 quart cans).....	do.....	2		
2	Chamois skins.....	do.....	2		
2	Dre sing, russet leather boxes.....	do.....	2		
2	Globel lanterns.....	In supply chest, tools.....	2		
6	Lavaline, 16-ounce cans.....	do.....	6		
8	Lye, powdered, cans, 1-pound.....	do.....	8		
8	Naphthaline.....	pounds.....	8		
1	Oil, clock, ounce, 1-ounce bottle.....	do.....	1		
4	Oil, hydroline, gallons, 5-gallon cans.....	do.....	4		
2	Oil, linseed, boiled, gallons.....	do.....	2		
1	Oil, linseed, raw, 1-pint cans.....	do.....	1		
2	Oil, lubricating.....	gallons.....	2		
15	Oil, neat's-foot.....	do.....	13		
		2 in supply chest, miscellaneous.			

*Allowance for six months of cleaning and preserving materials for one mountain battery—*  
Continued.

Number.	Article.	Where carried.		Property classification.	
		In pack.	In store.	Class.	Section.
2	Oil, slushing, light .....	gallons .....	2	X	10
2	Oil, coal .....	do. ....	2		
1	Oil, sperm .....	do. ....	In supply chest, miscellaneous.		
40	Paint, olive-drab, third-coat .....	pounds .....	40		
3	Paint, rubberine, gallons (1 gallon cans) .....	.....	3		
5½	Petrolatum (vaseline) ounces (in tin box) .....	.....	5½		
6	Polish, Gibson's soap, 16-ounce cans .....	.....	2 in supply chest, tools .....		
40	Sal soda, pounds, bulk .....	.....	40		
1	Sand paper No. 1½ .....	quire .....	1		
1	Sand paper No. 00 .....	do. ....	1		
28	Soap, castile .....	pounds .....	4 pounds, in supply chest, blacksmith's.		
			8 pounds in supply chest, miscellaneous.		
4	Soap, H. & H. cakes or "Paco" .....	.....	In supply chest, miscellaneous.		
24	Soap, saddle, Frank Miller's .....	pounds .....	10 pounds in supply chest, blacksmith's.		
65	Sponges, 4-inch .....	.....	5 in supply chest, saddler's .....		
5	Sponges, large size, 5½ or 6 inch .....	.....	2 in supply chest, miscellaneous.		
			3 in supply chest, saddler's .....		
			2 pounds in supply chest, tools.		
25	Waste, cotton, pounds, white .....	.....	4.75 pounds in supply chest, blacksmith's.		
			1.75 pounds in supply chest, miscellaneous.		
5	Wicks, lantern, size 0 .....	.....	In supply chest, tools .....		

*Allowance for six months of saddler's material for one mountain battery.*

Number.	Article.	Where carried.		Property classification.	
		In pack.	In store.	Class.	Section.
6	Awl blades, harness, assorted .....	.....	6	X	9
2	Buckles, bar, 1-inch, saalbach .....	In supply chest, saddler's .....	.....		
6	Buckles, bar, tongueless, ¾-inch .....	do. ....	.....		
8	Buckles, bar, tongueless, 1-inch .....	do. ....	.....		
5	Buckles, bar, tongueless, 1½-inch .....	do. ....	.....		
12	Buckles, center bar, ¾-inch .....	do. ....	.....		
6	Buckles, center bar, ¾-inch .....	do. ....	.....		
3	Buckles, center bar, ¾-inch .....	do. ....	.....		
2	Buckles, center bar, 1-inch .....	do. ....	.....		
7	Buckles, center bar, 1½-inch .....	do. ....	.....		
3	Buckles, center bar, 1½-inch .....	do. ....	.....		
2	Buckles, roller, ¾-inch .....	do. ....	.....		
5	Buckles, roller, ¾-inch .....	do. ....	.....		
1	Buckles, roller, 1-inch .....	do. ....	.....		
9	Buckles, roller, 1½-inch .....	do. ....	.....		
6	Buckles, satchel, ½-inch .....	do. ....	.....	X	10
3	Buckles, wire, ½-inch .....	do. ....	.....		
2	Buckles, wire, ¾-inch .....	do. ....	.....		
12	Buckles, wire, ¾-inch .....	do. ....	.....		
5	Buckles, roller, tongueless, ¾-inch .....	do. ....	.....		
10	Cincha straps, aparejo .....	.....	10		
3	Cheek "D" .....	In supply chest, saddler's .....	.....		
10	Chock plates, upper and lower, steel .....	do. ....	.....		
5	Chock staples .....	do. ....	.....		
20	Duck cotton, olive-drab, 26-inch, No. 8, yards .....	.....	20		
10	Duck cotton, olive-drab, 22-inch, No. 2, yards .....	In supply chest, saddler's .....	.....		
18	Duck cotton, olive-drab, 22-inch, No. 1, yards .....	do. ....	.....		
14	End buckles, 1-inch .....	do. ....	.....		
2	End clips, ¾-inch .....	do. ....	.....		
10	End clips, 1-inch .....	do. ....	.....		
19	End clips, 1½-inch .....	do. ....	.....		



## Allowance for six months of saddler's material for one mountain battery—Continued.

Number.	Article.	Where carried.		Property classification.	
		In pack.	In store.	Class.	Section.
3	Foot staple, high.....	In supply chest, saddler's.....			
6	Foot staple, low.....	do.....		IX	5
3	Foot staple, semicircular.....	do.....			
1	Hafts, patent awl, No. 146, with wrench.....	do.....	1	X	10
16	Hook, end, brass wire.....	do.....		IX	5
2	Hook, wire (for link).....	do.....		IV	5
2	Leather, bridle, backs.....	1 back in supply chest, tools.....	1		
1	Leather, collar, backs.....	do.....	1		
150	Leather harness, backs..... pounds.....	1 back in supply chest, tools.....	(1)	X	10
1	Leather, latigo..... side.....	In supply chest, saddler's.....			
2	Nails, saddle.....	do.....			
1	Needle, glover's No. 3, paper.....	In saddler's tool kit.....			
1	Needle, harness, No. 4, papers.....	do.....		X	9
1	Needles, harness, No. 5, papers.....	do.....			
1	Needles, harness, No. 6, papers.....	do.....			
2	Ornaments, brow band, copper.....	In supply chest, saddler's.....			
3	Ovals, saddle.....	do.....		IX	5
2	Ovals, saddle bag.....	do.....			
1	Pins, screw brass, $\frac{3}{4}$ -inch, No. 2, 1 gross.....	do.....			
5	Rendering ring, $1\frac{1}{2}$ -inch diameter.....	do.....			
3	Ring, $\frac{1}{2}$ -inch diameter, saddle-bag.....	do.....			
6	Ring, $1\frac{1}{2}$ -inch diameter, saddle.....	do.....			
2	Ring, $1\frac{1}{2}$ -inch diameter, throatstrap.....	do.....			
14	Ring, 2-inch diameter, halter.....	do.....			
3	Ring, 4-inch diameter, quarterstrap.....	do.....			
9	Ring, D, 1-inch diameter, feed bag.....	do.....		X	10
$\frac{1}{2}$	Rivets and burs, brass, $\frac{1}{2}$ -inch, No. 10, pounds.....	do.....			
1	Rivets and burs, brass, $\frac{5}{8}$ -inch, No. 10, pounds.....	do.....			
$\frac{1}{2}$	Rivets and burs, brass, $\frac{3}{4}$ -inch, No. 10, oval head, pounds.....	do.....			
1	Rivets and burs, brass, 1-inch, No. 8, oval head.....	do.....			
210	Rope, $\frac{3}{4}$ -inch, halter, bridle, manila hemp, feet.....	Carried where convenient.....		IV	2
300	Rope, $\frac{1}{2}$ -inch, halter, manila hemp..... feet.....	do.....		IV	8
1	Screw, brass, 1-inch, No. 6..... gross.....	In supply chest, saddler's.....		X	10
6	Sheepskins with wool on.....	do.....	6		
1	Shields, saddle, 11-inch.....	do.....			
1	Shields, saddle, 11 $\frac{1}{2}$ -inch.....	do.....		IX	5
1	Shields, saddle, 12-inch.....	do.....			
2	Snap hook, canteen, cavalry.....	do.....			
2	Snap, German, $\frac{1}{2}$ -inch.....	do.....		X	10
8	Snap hook, haversack, 1-inch.....	do.....			
5	Snap, swivel, oval loop, 1 $\frac{1}{2}$ -inch.....	do.....		IX	1
2	Snap, swivel, 1-inch, No. 16.....	do.....		X	10
9	Snap, German, 1-inch.....	do.....			
15	Squares, halter.....	do.....			
9	Straploop (feed bag) 1 by $\frac{1}{2}$ inch, brass wire.....	do.....		IX	5
2	Stud, saddle bag.....	do.....			
1	Tacks, copper, No. 12, $\frac{1}{2}$ -pound paper.....	do.....			
1	Tacks, copper, No. 20, $\frac{1}{2}$ -pound paper.....	do.....			
1	Thimble, aluminum lined, steel.....	do.....			
1	Thread, carpet, No. 18, olive-drab..... pounds.....	In supply chest, saddler's, $\frac{1}{2}$ pound.....	$\frac{3}{4}$		
1	Thread, shoe, No. 3, brown..... pounds.....	In supply chest, saddler's.....			
1	Thread, shoe, No. 10, brown..... pounds.....	do.....			
2	Wax, stitching, brown winter..... pounds.....	1 pound in supply chest, saddler's.....	1	X	
2	Webbing, olive-drab, cotton, heavy, $\frac{5}{8}$ -inch, yards.....	In supply chest, saddler's.....			
22	Webbing, olive-drab, cotton, heavy, 1-inch, yards.....	5 yards in supply chest, saddler's.....	17		
10	Webbing, olive-drab, halter, 1 $\frac{1}{2}$ inches, yards.....	do.....	5		
13	Webbing, olive-drab, jute, 3 $\frac{1}{2}$ inches, yards.....	do.....	13		
<i>For polo equipment.</i>					
2	Buckles, wire, $\frac{1}{2}$ -inch.....	In supply chest, saddler's.....			
2	Buckles, wire, $\frac{3}{8}$ inch.....	do.....			
12	Buckles, wire, $\frac{1}{4}$ -inch.....	do.....			
4	Buckles, wire, $\frac{1}{4}$ -inch.....	do.....			
2	Buckles, nickel-plated, stirrup plate, 1 $\frac{3}{8}$ -inch.....	do.....		X	10
6	Buckles, nickel-plated, girth, 1-inch.....	do.....			
4	Ring, $\frac{1}{2}$ -inch diameter.....	do.....			
5	Web, linen, straining, 3 $\frac{1}{2}$ inches..... yards.....	do.....			
7	Web, linen, straining, 5 inches..... yards.....	do.....			



## Reserve supply for war service.

Num- ber.	Article.	Where carried.	Property classi- fication.	
			Class.	Section.
2	Buckles, bar, tongueless, $\frac{3}{8}$ -inch.....	In store <sup>1</sup> .....	X	10
3	Buckles, bars, tongueless, 1-inch.....	do.....		
4	Buckles, center bar, $\frac{3}{8}$ -inch.....	do.....		
2	Buckles, center bar, $\frac{1}{2}$ -inch.....	do.....		
1	Buckle, center bar, $\frac{3}{8}$ -inch.....	do.....		
2	Buckles, center bar, $\frac{1}{2}$ -inch.....	do.....		
1	Buckles, center bar, $\frac{1}{2}$ -inch.....	do.....		
3	Buckles, roller, $\frac{1}{2}$ -inch.....	do.....		
2	Buckles, roller, tongueless, $\frac{3}{8}$ -inch.....	do.....		
4	Buckles, $\frac{3}{8}$ -inch, wire.....	do.....		
2	Burner, lantern, Dietz Vesta.....	do.....		
1	Cheek "D".....	do.....		
1	Chamois skin not smaller than 13 by 17 inches.....	do.....		
5	Chock plate, upper and lower.....	do.....		
3	Chock staple.....	do.....		
2	Dressing, russet leather, boxes, 16-ounce.....	do.....		
5	End buckle.....	do.....		
2	Globe lantern.....	do.....		
5	Hook, double, brass wire.....	do.....		
5	Hook, end, brass wire.....	do.....		
1	Leather, bridle, backs.....	do.....		
1	Leather, collar, backs.....	do.....		
30	Leather, harness, backs, pounds.....	do.....		
1	Leather, latigo, side.....	do.....		
1	Nails, saddle.....	do.....		
1	Oil, clock, ounce, 1-ounce bottles.....	do.....		
3	Oil, hydroline, gallons, 5-gallon cans.....	do.....		
12	Oil, neatsfoot, gallons, 1 and 2 gallon cans.....	do.....		
$\frac{1}{2}$	Oil, slushing, light, gallons, 1 and 2 gallon cans.....	do.....		
$\frac{1}{2}$	Oil, sperm, gallons.....	do.....		
1	Oil, coal, gallons.....	do.....		
1	Oil, lubricating, gallons.....	do.....		
1	Ornament, brow band.....	do.....		
1	Ring, $\frac{3}{8}$ -inch diameter, saddlebag.....	do.....		
2	Ring, $\frac{1}{2}$ -inch diameter, halter.....	do.....		
5	Ring, 2-inch diameter, halter.....	do.....		
2	Ring, 4-inch diameter, cincha strap.....	do.....		
1	Ring, 4-inch diameter, quarter strap.....	do.....		
3	Ring, "D," 1-inch diameter, feed bag.....	do.....		
$\frac{1}{2}$	Rivets and burs, brass belt, $\frac{3}{8}$ -inch, No. 10, pounds.....	do.....		
1	Rivets and burs, brass, $\frac{3}{8}$ -inch, No. 10, pounds.....	do.....		
10	Sal soda, pounds, bulk.....	do.....		
3	Snap hook, haversack, 1-inch.....	do.....	IX	1
5	Snap, swivel, oval loop, $\frac{1}{2}$ -inch.....	do.....	X	10
3	Snap hook, feed bag, German pattern 1-inch.....	do.....	IX	5
5	Squares, halter.....	do.....		
16	Soap, castile, pounds.....	do.....	X	10
3	Soap, H. & H. cakes or "Paco".....	do.....		
15	Soap, saddle, Frank Miller's, pounds.....	do.....	IX	5
20	Sponges, 5-inch.....	do.....		
3	Strap loop, feed bag, 1 by $1\frac{1}{2}$ inch, wire.....	do.....	X	10
1	Stud, saddlebag.....	do.....		
1	Tacks, copper, 12-ounce, papers.....	do.....	X	10
1	Tacks, copper, 20-ounce, papers.....	do.....		
1	Thread, carpet, No. 18, olive-drab, pounds.....	do.....	X	10
1	Thread, shoe, No. 3, brown, pounds.....	do.....		
1	Thread, shoe, No. 10, brown, pounds.....	do.....	X	10
15	Waste, cotton, pounds, white.....	do.....		
1	Wax, stitching, pounds, brown, winter.....	do.....	X	10
2	Wick, lantern, size 0.....	do.....		

<sup>1</sup> No material will be drawn from this supply for making repairs and replacements, except in sudden calls for field service if necessary to replace missing items of the regular supplies. To avoid deterioration, all perishable articles should be replaced by similar ones received, with the regular six months' allowance.

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June 10, 1912.

Revised September 15, 1916.

Form No. 1761.

Ed. Sept. 15-16 800.



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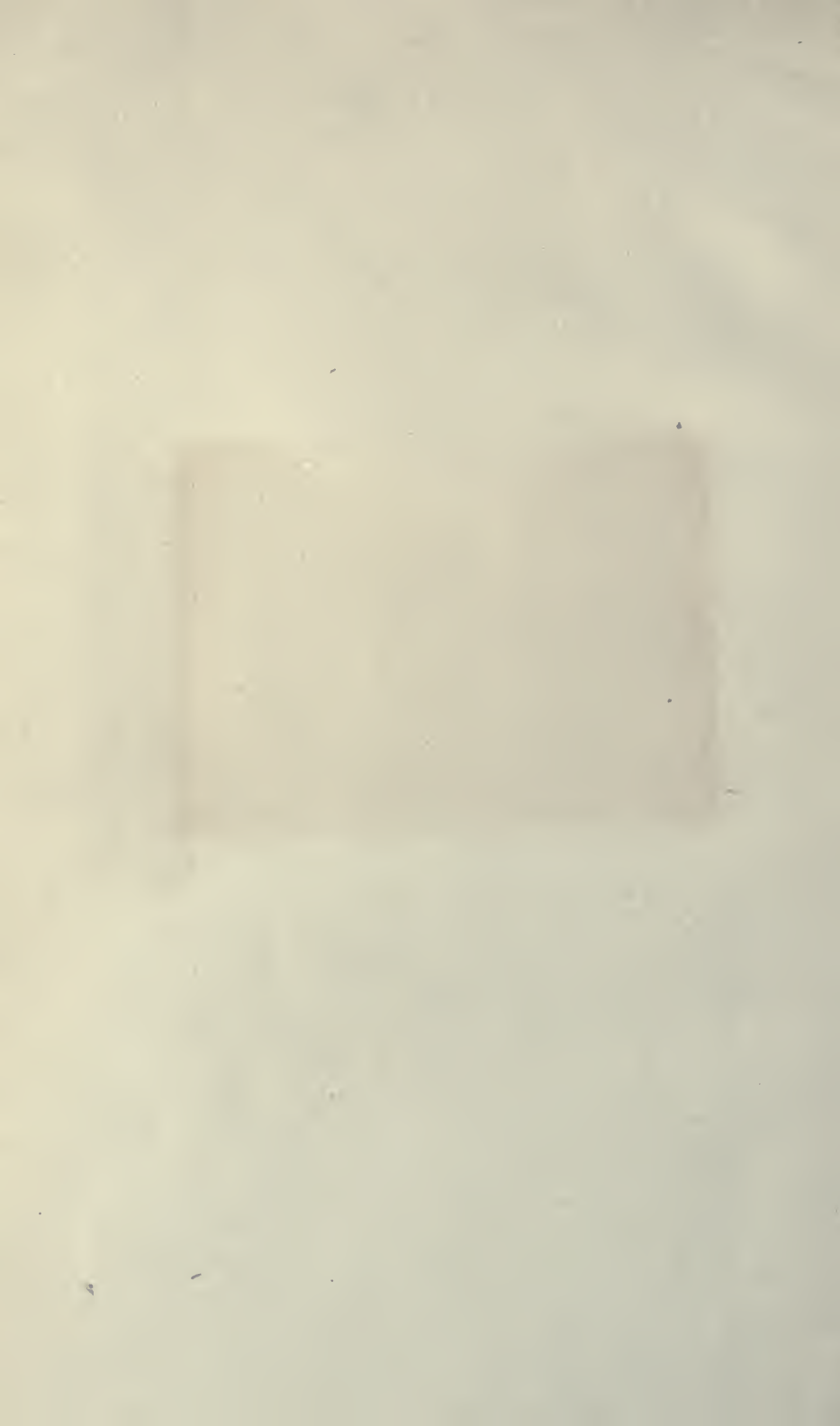












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